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THE BOEING COMPANY

CODE IDENT NO. 81205

NUMBER T2-2555, Volume III

TITLE Launch Control System Test Report, NRA III-1

MODEL NO. WS-133A CONTRACT NO. AF 04(647)-289

ISSUE NO. 46-1 ISSUED TO DDC

THIS ISSUE SUPERSEDES
ISSUE 46

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		(DATE)

REV SYM B

U3 4287 9035 ORIG. 8/62

2-5142-2

ACTIVE-CHANGED PAGE

ACTIVE			CHANGED					ACTIVE			CHANGED				
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SECTION	PAGE	DATE	SECTION	REVISED	ADDED	DELETED	DATE	SECTION	PAGE	DATE	SECTION	REVISED	ADDED	DELETED	DATE
	1 thru 53 Original Release	1/23/63													
A	1			X			4/30/63								
	2			X			4/30/63								
	3			X			4/30/63								
	4			X			4/30/63								
	5			X			4/30/63								
A	1 thru 3 Reveision B	6/28/63			X		6-28-30								
B	1 thru 28 Revision B	6/28/63			X		6-28-30								
C	1 thru 48 Revision B	6/28/63			X		6-28-30								
D	1 thru 236 Revision B				X		6-28-30								

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
A	Changed NRA III-A to NRA III-1A		
B	Document completely revised. All data contained in original release is incorporated in this revision in Section C.	6/28/3	[illegible] 7/1/63

U3 4287 9028 ORIG. 8/62 2-5142-2

THE BOEING COMPANY

NUMBER T2-2555, Vol. III

SECTION TITLE Introduction to NRA III-1A and NRA III-1B Test Report

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LIST OF FIGURES INDEX OF SECTION D

LIST OF FIGURES INDEX OF SECTION D

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(cont'd)

REFERENCES

Documents

D2-13406, Vol. III, "Launch Control System Test Procedures, Network Resolution Area".

D2-13405, "Network Resolution Area (NRA) Test Program Plan, Block Change I".

D2-4853-1, "Launch Control System Electrical Load Analysis, Operational Launch Facility".

D2-4853-2, "Launch Control System Electrical Load Analysis, Operational Launch Control Facility".

Drawings

25-33093, sheets 1, 3, and 12 -- Equipment Installation - NRA

25-34198, sheets 1, 4, and 10 -- Cable Installation - NRA

LIST OF ABBREVIATIONS

AC	Alternating Current
A/CO	Assembly and Checkout
CB	Circuit Breaker
CCC	Communications Control Console
CCP	Communications Control Panel
CM	Centimeter
CMPG	Command Message Processing Group
Cont.	Continuous
CPS	Cycles per Second
CTE	Cable Termination Equipment
DAC	Data Analysis Central
DC	Direct Current
DDG	Digital Data Group
DPE	Data Processing Equipment
ECP	Engineering Change Proposal
ESA	Electrical Surge Arrestor
Fig.	Figure
G&C	Guidance and Control
H&D	Hardened and Dispersed
HVC	Hardened Voice Channel
KVA	Kilovolt-Ampere
LCC	Launch Control Console
LCF	Launch Control Facility

LIST OF ABBREVIATIONS (Cont'd)

LF	Launch Facility
LSU	Line Selector Unit
MCM	One-thousand Circular Mil
MG	Motor-Generator
MS	Milliseconds
MV	Millivolts
NCU	Nozzle Control Unit
Neg.	Negative
NRA	Network Resolution Area
OGE	Operational Ground Equipment
P-P	Peak to Peak
P/G	Programmer Group
Pos.	Positive
Pwr.	Power
Ref.	Reference
RFI	Radio Frequency Interference
RMS	Root Mean Square
RTS	Repeater Telephone Set
SCN	Sensitive Command Network
SCNT	SCN Test
SCMPG	Status Command Message Processing Group
SCS	Safety Control Switch

LIST OF ABBREVIATIONS (Cont'd)

SIN	Sensitive Information Network
SMPG	Status Message Processing Group
S/N	Serial Number
TB	Terminal Board
TCSS	Telephone Connecting and Switching
TSE	Test Support Equipment
TTC	Telephone Transmitter Control
W	Wattmeter
VA	Volt-Ampere
VAC	Volts Alternating Current
VRSA	Voice Recording Signal Assembly

1.0 INTRODUCTION

1.1 Purpose and Scope

1.1.1 This document presents all test reports for the Network Resolution Area (NRA) III-1 Test Program. NRA III-1 tests are concerned with the H&D Power System and its associated loads. These reports present and evaluate data on the Power System, the Launch Control System loads connected to the Power System, and the operation of the integrated LCS. A complete description of the NRA Test Program is contained in D2-13405, "Network Resolution Area Test Program Plan, Block Change I".

1.2.0 Objectives

1.2.1 In general, NRA III-1 test objectives were to:

1.2.1.1 Analyze and verify loads on the H&D Power System.

1.2.1.2 Verify compatibility between the H&D Power System and the interconnected Launch Control System (LCS).

1.2.1.3 Investigate the effects of Power System parameter variation upon the operation of the LCS.

1.3.0 Background

1.3.1 NRA III-1 is divided into two parts, NRA III-1A and NRA III-1B. These parts are contained in Sections C and D respectively.

1.3.1.1 NRA III-1A tests verify compatibility of the Programmer Group and G&C Coupler with the NRA H&D Power System. The Programmer Group and Coupler are operated in conjunction with associated Base Activation Test Equipment to simulate most functions of normal operation.

1.3.1.2 NRA III-1A tests were conducted with the equipment connected per Figure 3.0.0.0-2. Test Number 3.2.2.1 used the optional configuration denoted by flagnote Number 7. This optional connection allows operation at the Programmer Group and Coupler on laboratory power. All other NRA III-1A tests were conducted using H&D Power.

1.3.1.3 NRA III-1B tests investigate the effects of operational loads on the H&D Power System, analyze LCS loads, and investigate the effects of Power System variations on the interconnected LCS.

1.3.1.4 NRA III-1B tests were conducted with the equipment connected per Figure 3.0.0.0-1. Due to inavailability of certain items of equipment or limitations on the use of equipment, deviations were made from this configuration. These deviations are identified with flagnotes on Figure 3.0.0.0-1.

1.3.2 The numbers of the test reports contained within refer directly to the Test Procedure numbers contained in D2-13406, Vol. III, "Launch Control System Test Procedures, Network Resolution Area." This procedures document is a compilation of Test Requests to EDL/NRA for tests relating to the Power System.

1.3.3 Test procedure and report numbering has the following pattern:

1.3.3.1 The first number indicates the NRA Test Program number, and will always be a three (3) for an NRA III Test.

1.3.3.2 The second number indicates location of the equipment in test, either the LCF (No. 1) or LF (No. 2).

1.3.3.3 The third number indicates that the test is a load analysis test (No. 1), a compatibility test (No. 2) or a parameter variation test (No. 3).

1.3.3.4 The fourth number is the test number in the sub-group determined by the preceding numbers.

1.3.4 As an example, test 3.1.1.2 indicates: NRA III (3), LCF (1), Load Test (1), Test Number (2).

1.3.5 Test data was recorded on M&IR Test Logs. The Test Logs are on file in the Network Resolution Area Laboratory. During NRA III-1A, selected interface signals were recorded with the NRA Instrumentation system. The oscillograph records made during the test are on file in the NRA.

1.4 Summary

1.4.1 Data on the Load Tests performed includes the following information:

1.4.1.1 Photographs of current and voltage transients caused by the on-off cycling of operational loads. In some equipment, such as the SCN, the current inrush at turn-on was quite large, exceeding the nominal current ratings of the Power Supply Group DC supplies by factors of two or three (see tests 3.1.1.4 and 3.2.1.4).

1.4.1.2 Measurements of noise and ripple at the power inputs to equipment in the LCS.

1.4.1.3 Steady-state measurements of voltage, current, frequency, and power under static or average load conditions. Each individual item of equipment tested was connected to other equipment in the LCS while these measurements were made.

1.4.1.4 Measurements of the preceding quantities under conditions of maximum or changing load.

1.4.2 In each Test Report on the load tests, a comparison is made between D2-4853-1 or D2-4853-2 "Launch Control System Electrical Load Analysis, LF or LCF", and test results. The comparison is made to satisfy requests for verification of data in D2-4853.

1.4.3 Compatibility tests performed verified:

1.4.3.1 Operation of the Programmer Group and G&C Coupler on H&D power, under static and dynamic load conditions. Base Activation Test Equipment was used to simulate most functions of normal LF operation.

1.4.3.2 Operation of the Sensitive Command Network (SCN) during transfers to and from primary power. Power transfers were performed in the LF only due to inavailability of an operable LCF M-G Set.

1.4.4 Voltage variation tests investigated the effects of low input voltage to equipment in the LCS. A more detailed summary of these tests is given in Paragraph 4.0 of Section B.

2.0 Equipment in Test

2.1 NRA III - 1A

2.1.1 Launch Facility

2.1.1.1 Figure A 1201 Programmer Group OA-3388/GSW-4, (403), P/N 25-22036-68 S/N 0001

2.1.1.2 Figure A 604 G&C Coupler P/N 550780107 S/N A002B

2.1.1.3 Figure A 695 G&C Coupler Test Set P/N 55-64-107 S/N CPD 0003

2.1.1.4 Figure A 1337 Distribution Box P/N 25-23468-32 S/N 0003

2.1.1.5 Figure A 1412 VRSA (Preprototype) EM-1

2.1.1.6 Figure A 3113 Dummy Decoder P/N 25-27158-14 S/N 004

2.1.1.7 Figure A 1234 Power Group P/N 25-22552-36 S/N 0002

2.1.1.8 Figure A 1283 Motor Generator P/N 10-20884-2 S/N 0001703

2.1.2 Assembly and Checkout Equipment

2.1.2.1 A/CO 100 LF Start-up Unit P/N 25-28001-3 S/N 001

2.1.2.2 A/CO 101 LF/SCN Interface Simulator P/N 25-28592-1 S/N 0001

2.1.2.3 A/CO 102 Missile Electronic Simulation Kit

2.2 NRA III - 1B

2.2.1 Launch Control Facility

2.2.1.1 Figure A 1243 Launch Control Console, OA-3384/GSW-4, (300), P/N 25-24172-14, S/N 0003

2.2.1.2 Telephone Transmitter Control, C-3937/GTC, P/N 1274013-503, S/N 0000003

2.2.2.1 Figure A 1289 Power Supply Group, OA-3385/GSW-4, (301) P/N 25-24197-40, S/N 0002

2.2.3.1 Figure A 1265 Digital Data Group, OA-3541/GYK-1(V), (303), P/N 8323662-501, S/N 0000004.

2.2.4.1 Figure A 1213A Command Message Processing Group, OA-3542/GYK-1(V) P/N 8323614-502, S/N 0000005.

2.2.5.1 FFigure A 1213B Status Message Processing Group, OA-3543/GYK-1(V), (305), P/N 8323614-502, S/N 0000004.

2.2.6.1 Figure A 1338 Communications Control Console, OA3460/GSW-4, (311), P/N 25-27095-5, S/N 0000005.

2.2.6.2 Telephone Transmitter Control C-3937/GTG, P/N 1274013-503, S/N 0000004

2.2.7.1 Figure A 1302 Telephone Connecting and Switching Set, (312), P/N 1274180, S/N 0000006.

2.2.8.1 Figure A 1364 Cable Termination Equipment, AN/GTC-11 (320), P/N 8319702-502, S/N 0000002

2.2.9.1 PAS Monitor Panel Assembly, P/N 820200 GI.

2.2.2 Launch Facility

2.2.2.1 Figure A 1251 Digital Data Group, OA-3593/GYK-2, (401), P/N 8323616-502, S/N 0000005

2.2.2.2 Figure A 1228 Status - Command Message Processing Group OA-3594/GYK-2, (402), P/N 8323617-501, S/N 0000005.

2.2.2.3 Figure A 1268 Command Signals Decoder, KY-412/GYK-2, P/N 8325136-502, S/N 0000004.

2.2.2.4 Figure A 1201 Programmer Group OA-3388A/GSW-4, (403), P/N 25-22036-89, S/N 0000008.

2.2.2.5 Figure A 1284 LF Power Supply Group, OA3386/GSW-4, (406), P/N 25-22552-361, S/N 0002

2.2.2.6 Figure A 1283 Motor Generator, PU-515/GSW-4, (409), P/N 10-20884-2, S/N 0001703.

2.2.2.7 Figure A 604 Guidance and Control Coupler, Wing I (412), P/N 550780107, S/N A002B.

2.2.2.8 Figure A 604 Guidance and Control Coupler, Wing II (412), P/N 55103-107, S/N AHB0003.

2.2.2.9 Figure A 1303 Repeater Telephone AN/GTC-9, (418), P/N 1274176-501, S/N 0000012.

2.2.2.10 Figure A 1337 Distribution Box, J-1264/GSW-4, (432), P/N 25-23468-32 S/N 0003.

2.2.2.11 Figure A 1412 Voice Reporting Signal Assembly, (1400) P/N 10-21330/0962 8000-601A, S/N P-3.

2.2.2.12 Figure A 1379 Battery Charger - Alarm Set Group, OA-3684A/GSQ-44, P/N 25-25561-44, S/N 0000004.

2.2.2.13 Figure A 1283 Batteries, P/N 10-20811-7, S/N's 0000001, 0000006, 0000007, 0000008, 0000009, 0000010, 0000013, 0000016, 0000017, 0000020, 0000051, 0000052.

2.2.3 Assembly and Checkout Equipment

2.2.3.1 LF Start-up Unit(s)

2.2.3.1.1 A/CO 100, Start-up Unit LF (280), P/N 25-28001, S/N 0001.

2.2.3.1.2 Figure A 4491, Start-up Unit LF (1202), P/N 25-33449-1, S/N 0000002

2.2.3.2 Missile Downstage and Electronics Simulation Kit(s)

2.2.3.2.1 A/CO 114, Missile Downstage Simulator, (279), P/N 25-28097-1, S/N 0001

2.2.3.2.2 Part of Figure A 4490, Simulator Electrical Functions Missile - Launch, SM 245/GSM-62.

2.2.3.2.3 A/CO 112 Junction Box and Cable Set, (254) P/N 25-28174-8, S/N 0001

2.2.3.2.4 Part of Figure A 4490, Distribution Box J-1291/GSM-62 (1201A) P/N 25-33734-1, S/N 0000012.

2.2.3.2.5 A/CO 372, Launch Events Recorder, (289), P/N 25-28035-1, S/N 0001

2.2.3.2.6 Part of Figure A 4490, Recorder, Signal Data RO--186/GSM-62 (1201C) P/N 25-35862-1, S/N 0000014.

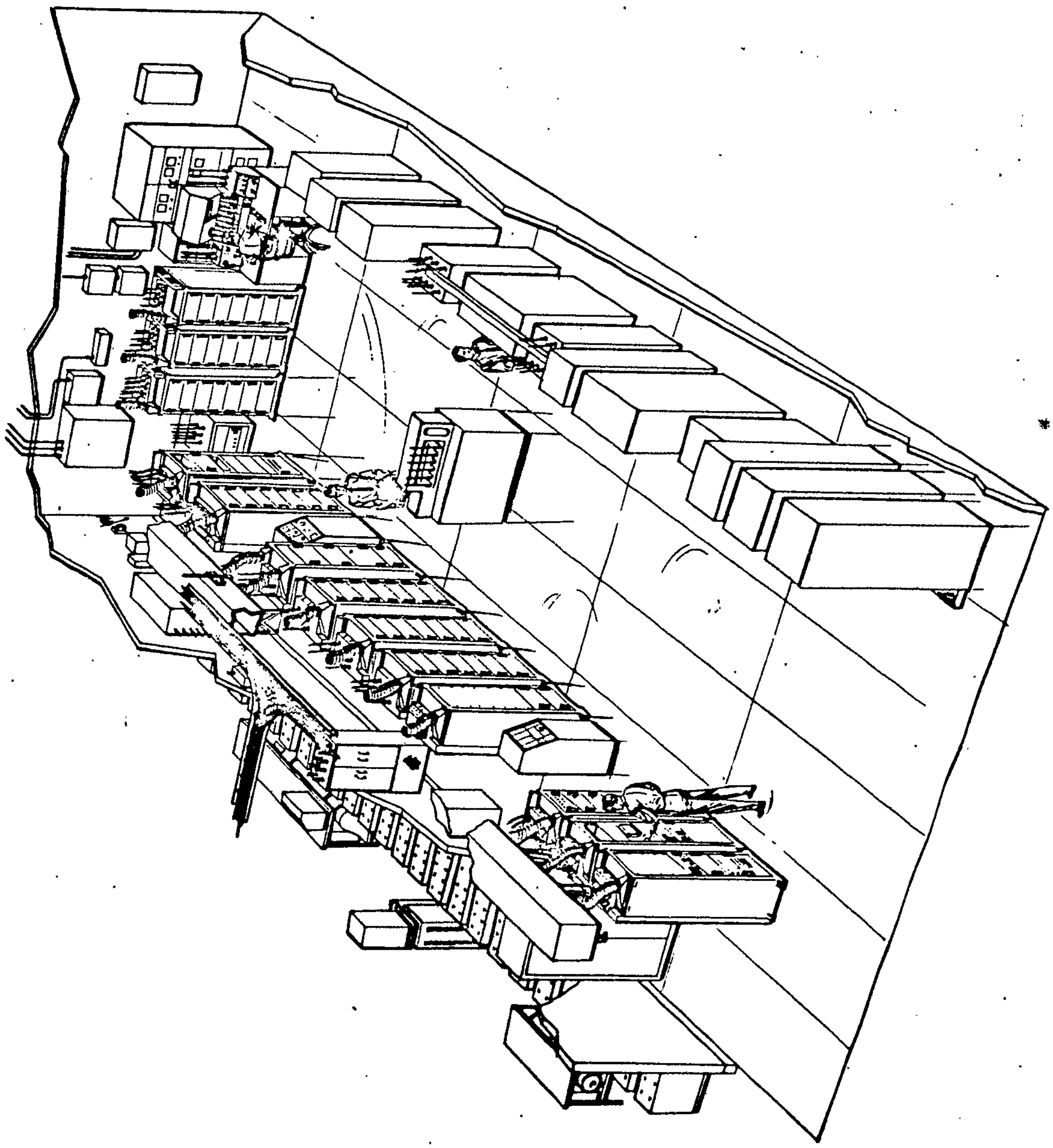
2.2.3.3 Simulator - G&C Coupler

2.2.3.3.1 Figure A 695, SE 106, P/N 31285-315 S/N AOC-R

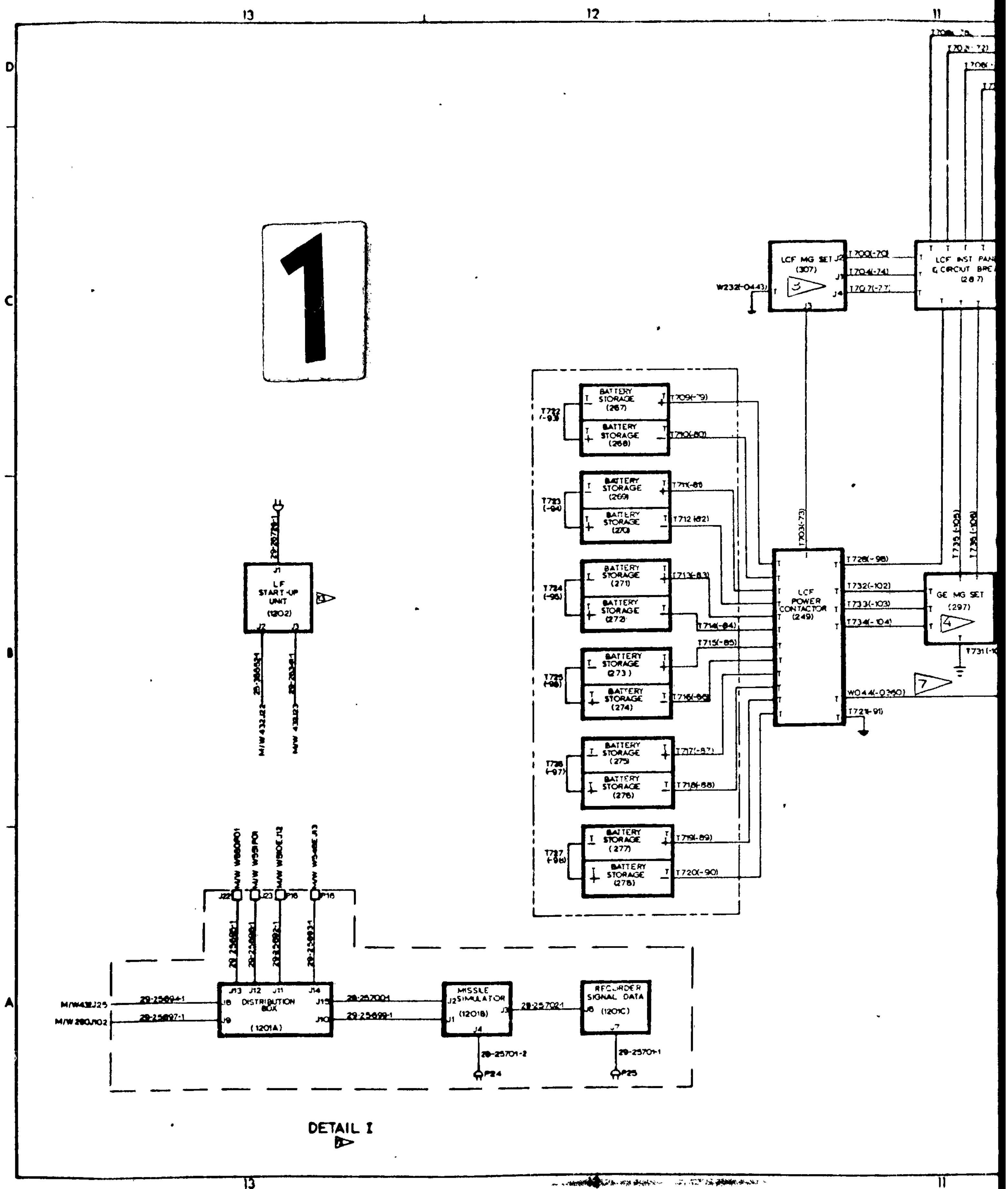
2.2.3.3.2 Figure A 695, C119B, P/N 60300-305 S/N AHC 0001

2.2.4 Test Support Equipment

2.2.4.1 See 25-33093 Sheet 1, for the required Test Support Equipment.



NETWORK RESOLUTION AREA LABORATORY



1
LCF MG SET (307)
LCF INST PANEL & CIRCUIT BRE (287)
W232(-0443)
T700(-70)
T704(-74)
T707(-77)
T703(-73)
BATTERY STORAGE (267)
BATTERY STORAGE (268)
BATTERY STORAGE (269)
BATTERY STORAGE (270)
BATTERY STORAGE (271)
BATTERY STORAGE (272)
BATTERY STORAGE (273)
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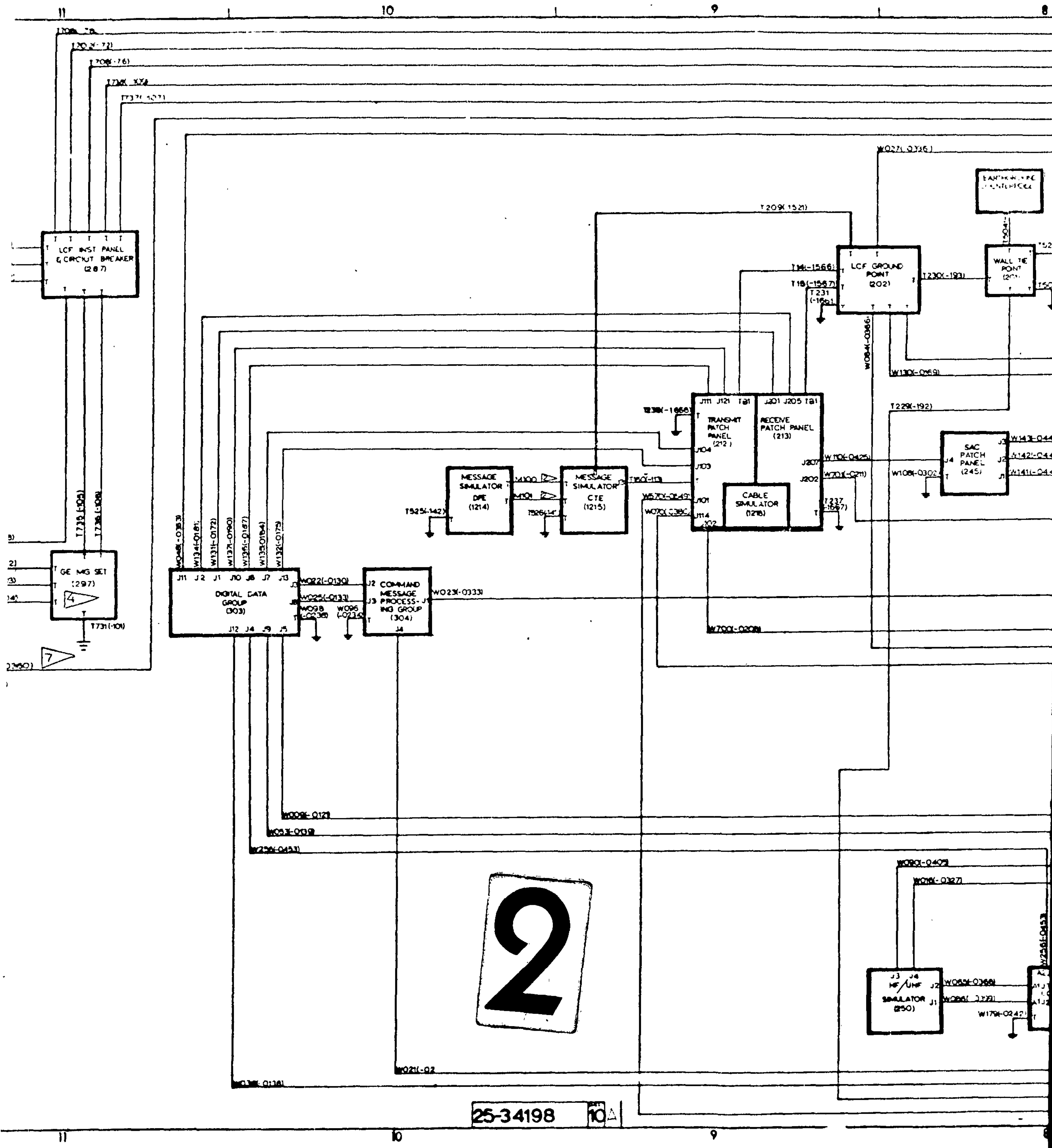
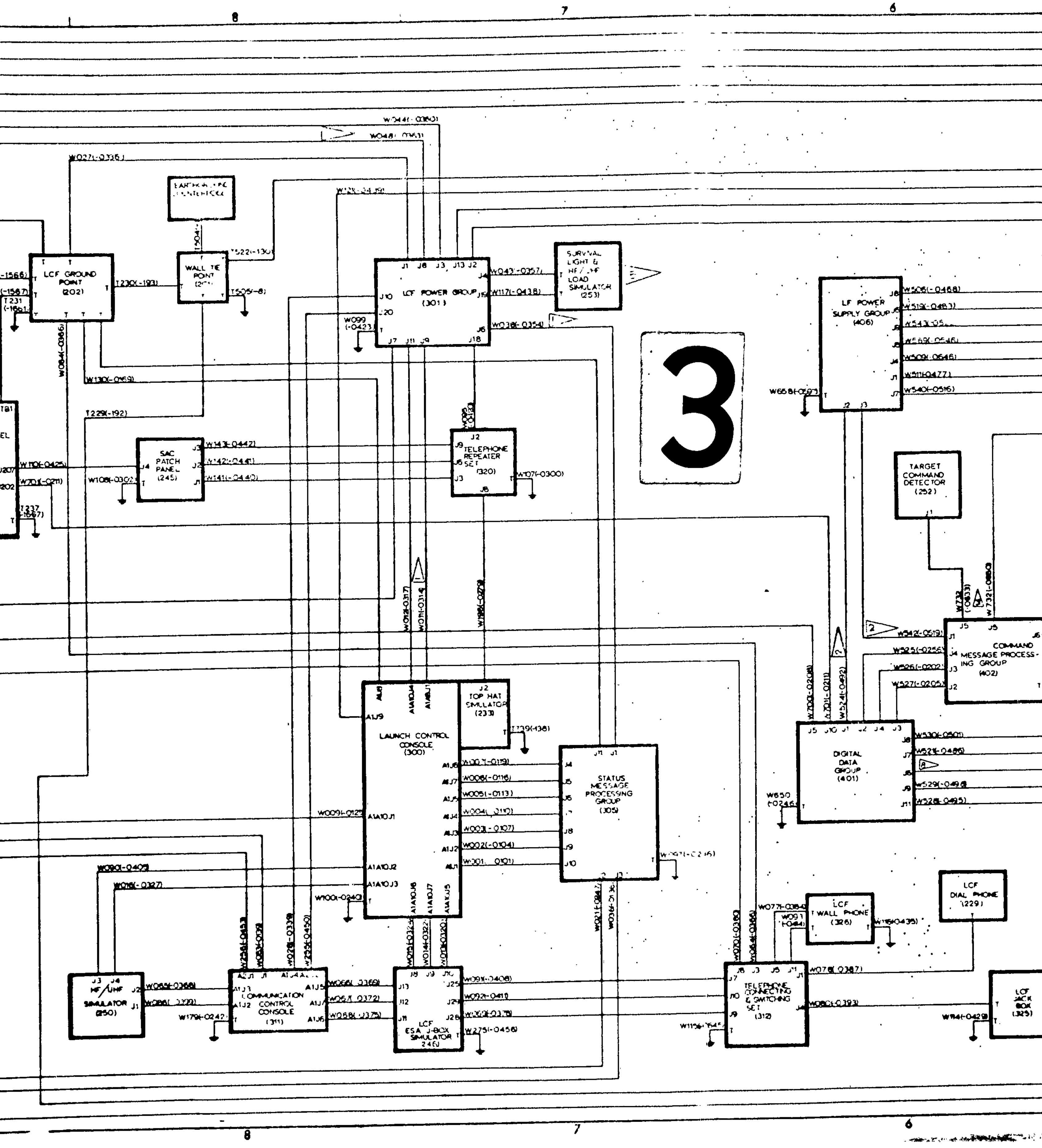
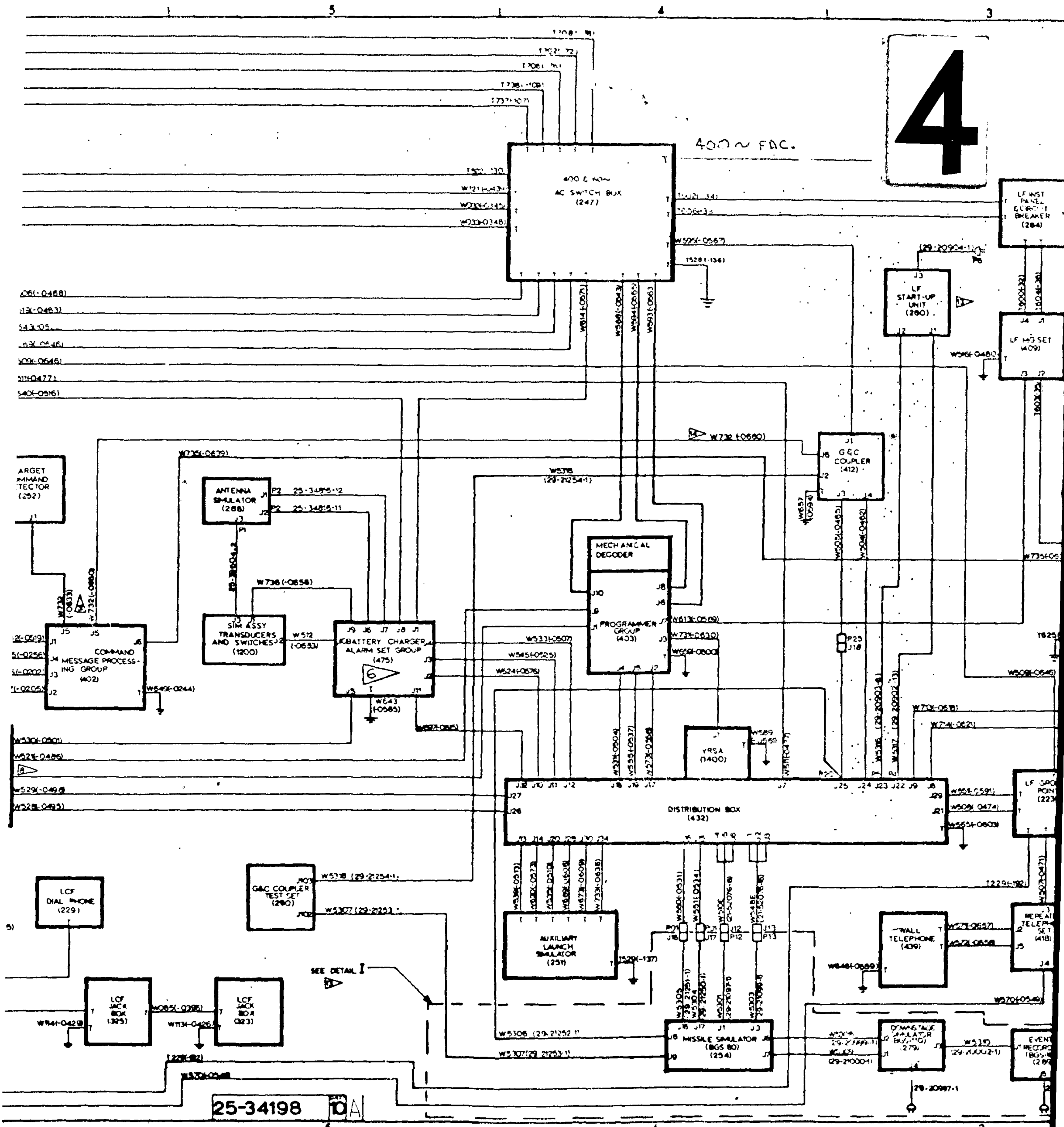
BATTERY STORAGE (278)
T709(-79)
T710(-80)
T712 (-82)
T713(-83)
T714(-84)
T715(-85)
T716(-86)
T717(-87)
T718(-88)
T719(-89)
T720(-90)
LCF POWER CONTACTOR (249)
T728(-98)
T732(-102)
T733(-103)
T734(-104)
T735(-105)
T736(-106)
GE MG SET (297)
W044(-0360)
T721(-91)
LF START-UP UNIT (1202)
M/W 432 J22
M/W 431J23
M/W 432 J25
M/W 280 J102
DISTRIBUTION BOX (1201A)
29-25694-1
29-25697-1
29-25700-1
29-25699-1
MISSLE SIMULATOR (1201B)
29-25702-1
RECORDER SIGNAL DATA (1201C)
29-25701-2
29-25701-1
P24
P25
13
12
11
D
C
B
A

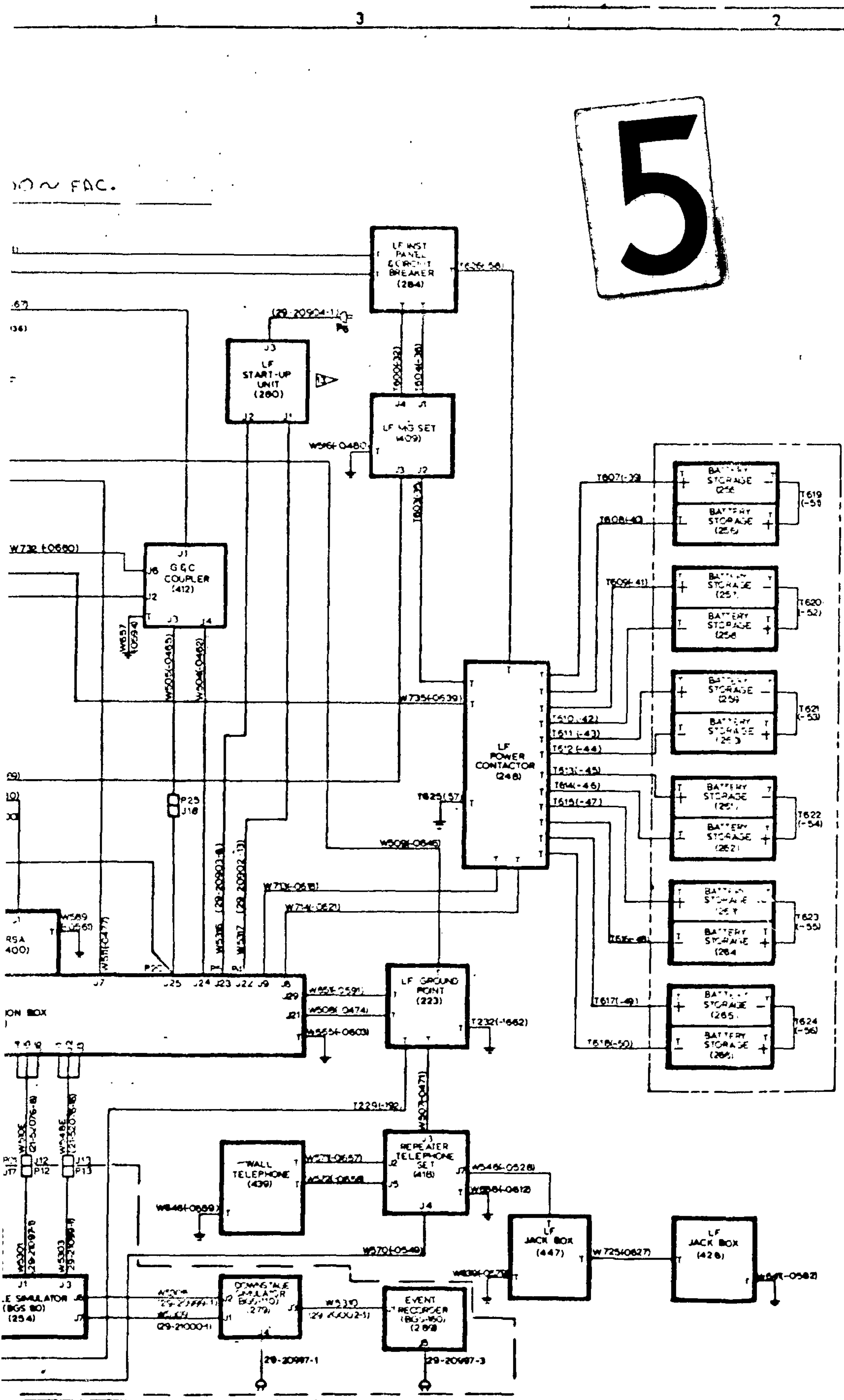
DETAIL I



LCF INST PANEL & CIRCUIT BREAKER (287)
GE MG SET (297)
DIGITAL DATA GROUP (303)
COMMAND MESSAGE PROCESSING GROUP (304)
MESSAGE SIMULATOR DPE (1214)
MESSAGE SIMULATOR CTE (1215)
TRANSMIT PATCH PANEL (212)
RECEIVE PATCH PANEL (213)
CABLE SIMULATOR (1216)
LCF GROUND POINT (202)
WALL TIE POINT
SAC PATCH PANEL (245)
HF/UHF SIMULATOR (250)
2
25-34198
10
11
10
9
8


8
7
6
LCF GROUND POINT (202)
WALL TIE POINT
LCF POWER GROUP (301)
SURVIVAL LIGHT & HF/UHF LOAD SIMULATOR (253)
LF POWER SUPPLY GROUP (406)
3
SAC PATCH PANEL (245)
TELEPHONE REPEATER SET (320)
TARGET COMMAND DETECTOR (252)
COMMAND MESSAGE PROCESSING GROUP (402)
LAUNCH CONTROL CONSOLE (300)
TOP HAT SIMULATOR (233)
STATUS MESSAGE PROCESSING GROUP (305)
DIGITAL DATA GROUP (401)
LCF WALL PHONE (326)
LCF DIAL PHONE (229)
HF/UHF SIMULATOR (250)
COMMUNICATION CONTROL CONSOLE (311)
LCF ESA J-BOX SIMULATOR (246)
TELEPHONE CONNECTING & SWITCHING SET (312)
LCF JACK BOX (325)


4
400~ FAC.
400 & 60~ AC SWITCH BOX (247)
LF INST PANEL CIRCUIT BREAKER (284)
LF START-UP UNIT (260)
LF MG SET (409)
G&C COUPLER (412)
ANTENNA SIMULATOR (288)
MECHANICAL DECODER
PROGRAMMER GROUP (403)
SIM ASSY TRANSDUCERS AND SWITCHES (1200)
BATTERY CHARGER ALARM SET GROUP (475)
COMMAND MESSAGE PROCESSING GROUP (402)
VRSA (1400)
DISTRIBUTION BOX (432)
AUXILIARY LAUNCH SIMULATOR (251)
G&C COUPLER TEST SET (290)
LCF DIAL PHONE (229)
LCF JACK BOX (325)
LCF JACK BOX (323)
MISSILE SIMULATOR (BGS 80) (254)
WALL TELEPHONE (439)
SEE DETAIL I
25-34198
10A



14 CONNECT 252 TO 402 WITH W732 WHEN THE WANG I 412 IS USED. 402 TO 412 WITH W732 (0660) WHEN WANG II 412 IS USED.

13 USE THE ACO [illegible] 2E4, 2[illegible], 2[illegible] W[illegible] [illegible] 252 ARE NOT AVAILABLE.

7 NOT CONNECTED TO THE LCF POW CONTRACTOR 249 FOR THE LCF LOAD

6 NOT INSTALLED FOR TESTS 3.2 3.2.1.3, 3.1.31, 3.2.31, 3.2.3.2 3.2.3.3

5 NOT CONNECTED

4 USED IN TEST 3.2.3.3

3 CONNECTED, BUT NOT USED IN TESTING

2 THESE CABLES CONNECTED TO AUXILIARY POWER SUPPLY FOR TEST 3.2.3.2

1 THESE CABLES CONNECTED TO AN AUXILIARY POWER SUPPLY FOR TEST 3.1.2.1

8 USE W[illegible] 21-50170-0217, 21-50170-0647, OR W[illegible] 21-50170-0642 DEPENDING ON THE TEST REQUIREME

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SECT. B PAGE 21

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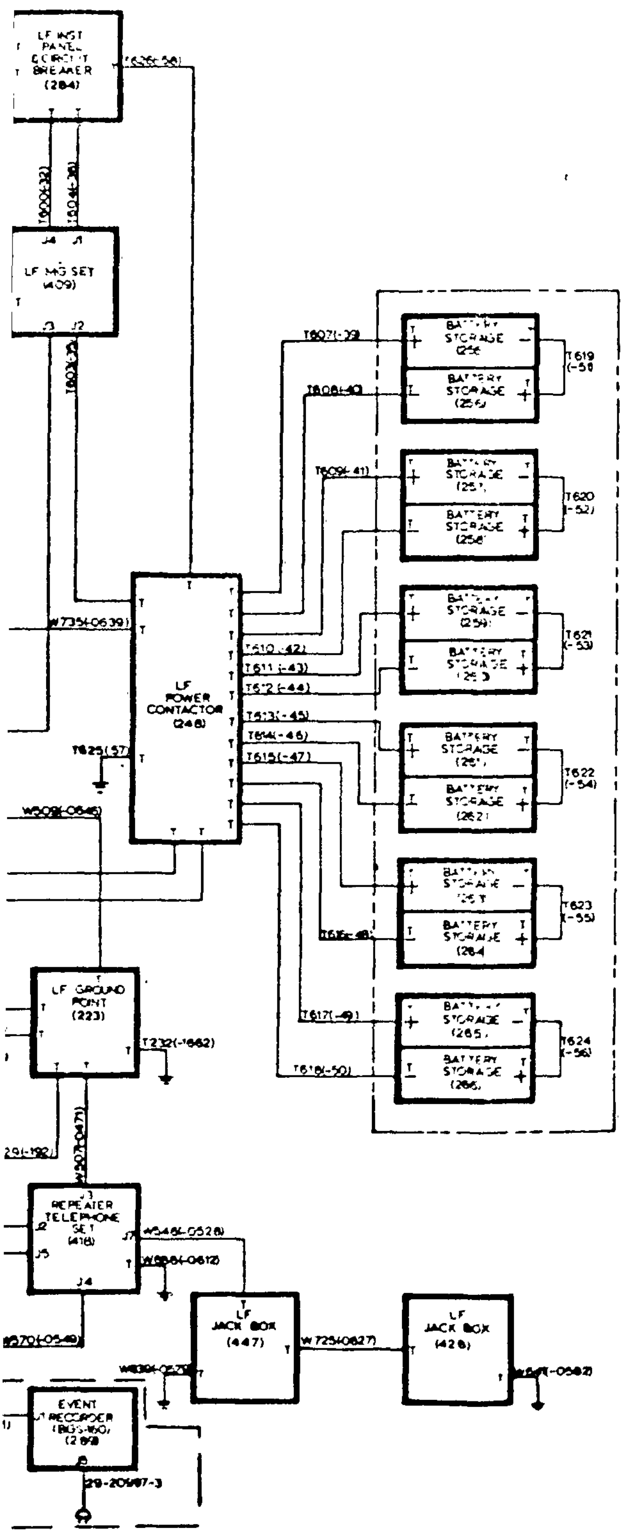
CABLE BLOCK DIAGRAM
NRA IIIB TESTING

FIG 3.0.0.0-1

THE BOEING
J25-34



14 CONNECT 252 TO 402 WITH W732 (-0682) WHEN THE WING I 412 IS USED. CONNECT 402 TO 412 WITH W732 (-0260) WHEN THE WING II 412 IS USED.

13 USE THE ACC EQUIPMENT 254, 279, 2[illegible], 29[illegible] W[illegible] 1202 ARE NOT AVAILABLE.

7 NOT CONNECTED TO THE LCF POWER CONTRACTOR 249 FOR THE LCF LOAD TESTS

6 NOT INSTALLED FOR TESTS 3.2.1.2, 3.2.1.3, 3.1.3.1, 3.2.3.1, 3.2.3.2, 3.2.3.3

5 NOT CONNECTED

4 USED IN TEST 3.2.3.3

3 CONNECTED, BUT NOT USED IN TESTING

2 THESE CABLES CONNECTED TO AN AUXILIARY POWER SUPPLY FOR TEST 3.2.3.2

1 THESE CABLES CONNECTED TO AN AUXILIARY POWER SUPPLY FOR TEST 3.1.2.1

8 USE W733 21-50170-0217, 21-50170-0647, OR W 822 21-50170-0642 DEPENDING ON THE TEST REQUIREMENTS

NO. T2-2555 VOL 3

SECT. B | PAGE 24

REV B

CABLE BLOCK DIAGRAM
NRA III-B TESTING

FIG 3.0.0.0-1

THE BOEING COMPANY

J 25-34198

EWA 8956

25-34198

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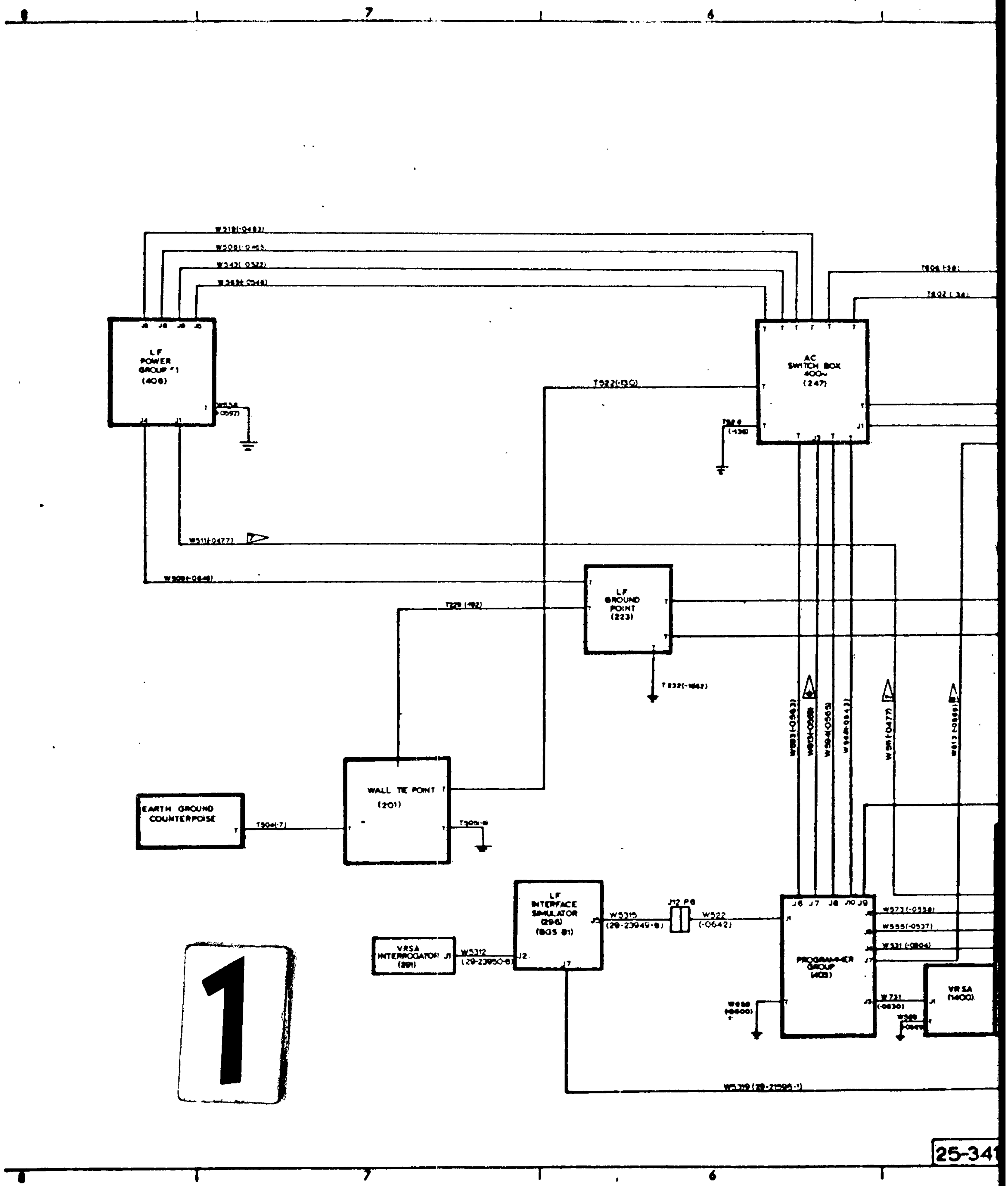
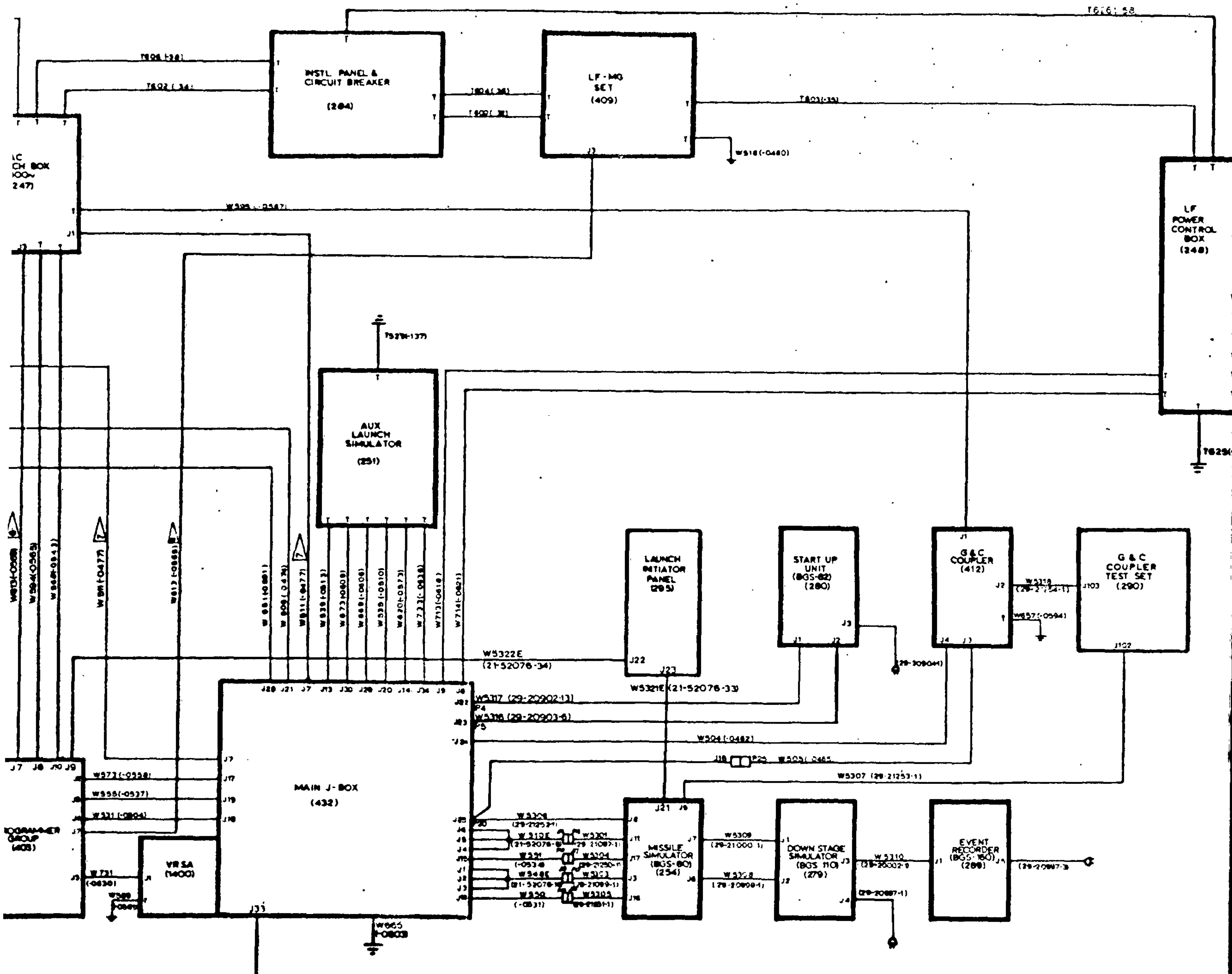
10

6



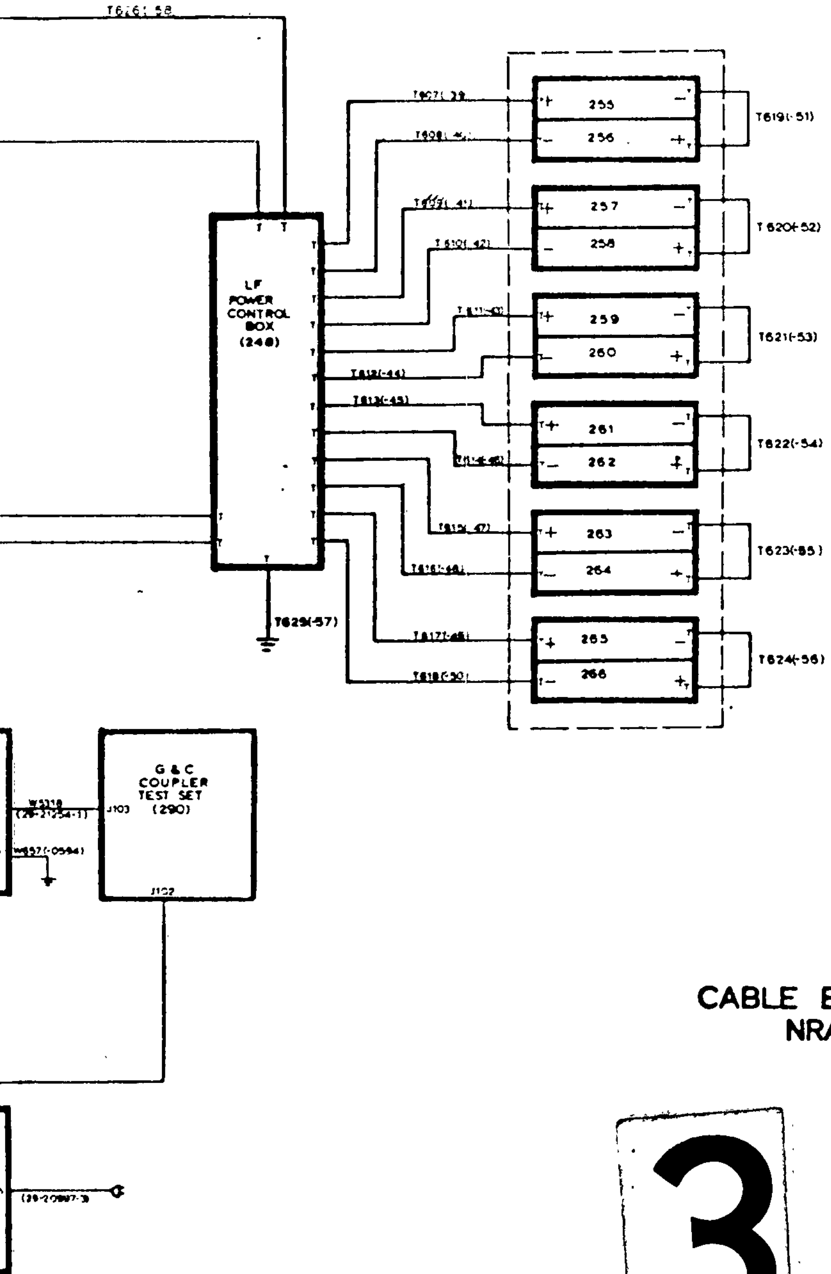
7
6
LF POWER GROUP #1 (406)
AC SWITCH BOX 400~ (247)
LF GROUND POINT (223)
WALL TIE POINT (201)
EARTH GROUND COUNTERPOISE
LF INTERFACE SIMULATOR (296) (BGS 81)
VRSA INTERROGATOR
PROGRAMMER GROUP (403)
VRSA (1400)
W511(-0477)
W5315 (29-23949-8)
W522 (-0642)
J12 P8
W5312
J6 J7 J8 J10 J9
1

2


INSTL. PANEL & CIRCUIT BREAKER (284)
LF-MG SET (409)
LF POWER CONTROL BOX (348)
AUX LAUNCH SIMULATOR (251)
LAUNCH INITIATOR PANEL (295)
START UP UNIT (BGS-82) (280)
G & C COUPLER (412)
G & C COUPLER TEST SET (290)
MAIN J-BOX (432)
VRSA (1400)
MISSILE SIMULATOR (BGS-80) (254)
DOWN STAGE SIMULATOR (BGS 110) (279)
EVENT RECORDER (BGS-160) (288)
W5322E (21-52076-34)
W5321E (21-52076-33)
W5317 (29-20902-13)
W5316 (29-20903-6)
W504 (-0482)
W5307 (29-21253-1)
W598 (-0587)
W518 (-0480)

25-34198 4 C

A		SEE DCN EWA 8956
B		SEE DCN EWA 8961
C	A4	SHADOW ROUTED VIDEO PANELS PLUS WHERE BETWEEN ... DRAWING EFF ON ...



[5] CONNECT CABLE W511 TO UNIT 247 INSTEAD OF UNIT 406 WHEN USING LAB POWER

[6] CONNECT CABLE 613 TO UNIT 247 INSTEAD OF UNIT 409 WHEN USING LAB POWER

CABLE BLOCK DIAGRAM
NRA III-IF TESTING

3

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REV B

FIGURE 3.0.0.0-2

THE BOEING COMPANY
J 25-34198

25-34198 4 C

4.0. **Summary of Low Voltage Testing**

4.1.0 Description

4.1.1 In NRA III-1B, several tests were conducted to investigate the effects of low input voltage to various racks in the Launch Control System. In these tests, input voltages were decreased below design tolerances. Normal system commands, such as test, SCNT, Launch, etc., were used to determine proper operation of the equipment. The voltage at which the equipment could no longer process the normal commands was defined to be the failure point. Voltages were not lowered beyond this point.

4.1.2 Equipment in test included the LF and LCF/SCN, the Launch Control Console, the Programmer Group, G&C Coupler, and the LF and LCF Power Supply Groups, Input voltage to the SAC/CTE was varied also, but due to a lack of 465L equipment, the failure point could not be determined for this item of equipment.

4.2.0 Procedures - General

4.2.1 The LF/SCN input voltage was lowered in Test 3.2.3.2. The Programmer Group and Coupler were connected, but were operated at normal input voltage. The LF was in Strategic Alert. Test, Calibrate, SCNT, a one vote Launch, Inhibit, and a two vote Launch were sent from the LCF. Status from the LF was observed at the LCC.

4.2.2 The LCF/SCN and LCC input voltages were lowered in Test 3.1.3.1. All commands were sent from the LCC and the command lines checked for presence of the correct message. Status messages were fed into the LCF/SCN, and the resulting status display at the LCC checked for validity.

4.2.3 In Test 3.2.3.3, the 400 cps voltage to the Programmer Group and Coupler was lowered. Test, Calibrate, and Launch Commands were sent to the Programmer Group. The SCN was connected, but operating at normal voltage.

4.2.4 In Test 3.1.1.1 (LCF) and 3.2.1.1 (LF) the 400 cps input voltage to the Power Supply Groups was lowered. Curves were plotted to show variation of output voltage with decreasing input voltage.

4.2.5 VRSA Emergency Power voltage was lowered in test 3.2.1.8. VRSA operation at low voltages was observed.

4.2.6 More detailed procedures are given in the Test Reports referenced above.

4.3.0 <u>Results</u>

4.3.1 The LCF/SCN functioned properly down to +18.8 volts input voltage. Below this voltage, the status lamps at the LCC were so dim that correct status display could not be verified. From the curves of Test Report 3.1.1.1, the Power Group input voltage for +18.8 volts was 62 volts (phase). Internal voltages in the SCN Power Supply drawers remained stable until the SCN input voltage reached 18 volts, or until 400 cps voltage dropped to 60 volts (phase). After this point, most voltages dropped off sharply (See Figures 3.1.1.1-4 and 3.1.1.1-5). One voltage, the +28 volt output (pin L) increased sharply at 18 volts input. See test reports 3.1.1.1 and 3.1.2.1 for more details.

4.3.2 No discrepancies were observed in the operation of the LF until 400 cycle phase voltage reached 70 volts. Below this point the Programmer Group could no longer complete a Launch or Test sequence. At 75 volts, channel #34 (RF Security Alarm) appeared on VRSA. At 65 volts, channel #34, #17 (Launch Acceptance Alarm) and all SCN faults except #32 and #33 appeared on VRSA. When 400 cps voltage reached 63 volts, the SCS Armed and could not be safed from the LCF. Finally, at 60 volts, the LF/SCN would no longer process command messages from the LCF. See test reports 3.2.1.1, 3.2.3.2, and 3.2.3.3 for more details.

4.3.3 VRSA would not report faults after emergency power voltage reached 24 volts. Refer to Test 3.2.1.8 for more details.

2-5142-2

THE BOEING COMPANY

NUMBER T2-2555, Vol. III

SECTION TITLE NRA III-1A Test Reports

PREPARED BY *Norman Noe* 6/29/63
N. L. Noe

SUPERVISED BY *Don Uhrich* 6/28/63
D. D. Uhrich

APPROVED BY *E G Helling* 7/1/63
E. G. Helling

APPROVED BY *R B Edgar* 7/2/63
R. B. Edgar

(DATE)

0000 REV. 2/63

REV SYM B

TEST REPORT 3.2.2.1

1. Test Title

   Programmer Group and Coupler on Lab Power.

2. Objective

   To establish a startup procedure when operating the Programmer Group and coupler on facility 400~ power.

3. Conclusions

   The Programmer Group and coupler startup procedures for NRA lab power operation were verified in this test. A timing chart is included in this report, showing the sequence of events in the startup.

4. Equipment in Test

   4.1 Programmer Group, Figure A 1201, P/N 25-22036-68, S/N 0001

   4.2 Coupler (C53C), Figure A 604, P/N 60950-305, S/N A0028

   4.3 Distribution Box, P/N 25-23468-32, S/N 0003

   4.4 BATE Gear, ACO 100, ACO 101, ACO 112, ACO 114, C-119

5. Test Description

   5.1 The equipment was connected per Figure 3.2.2.1-1

   5.2 All switches on the Launcher Auxiliary Simulator, Missile Simulator, LF Interface Simulator, Startup Unit, and Coupler Test Set were placed in the OFF or NORMAL position.

   5.3 Switches S1 and S2 at the AC switch box were placed in the UP position.

   5.4 The status of each of the following indicator lamps at the AC switch panel was verified:

   (a) MAIN POWER CONTROL lamp ON

   (b) EMERGENCY POWER TEST lamp OFF

   (c) POWER TEST OVERIDE lamp OFF

   (d) POWER TEST lamp OFF

   5.5 At the A/CO 100 the DISABLE DISCRETES and HALT PRIME switches were placed in the ON position.

   5.6 The MANUAL/LCF switch on the A/CO 101 was placed in the LCF position and the REMOTE/LOCAL switch at the A/CO 100 was placed in the REMOTE position.

   5.7 Ordnance and 400 cycle power was applied to the Programmer and Coupler.

5. Test Description (Cont'd)

5.8 All BATE Gear power switches were turned ON

5.9 The LCF/MANUAL switch at the A/CO 101 was placed back to the MANUAL position and the REMOTE/LOCAL switch back to the LOCAL position on the A/CO 100.

5.10 The C-119 was turned ON

5.11 The SHUT DOWN SITE switch was depressed at the P/G

5.12 The NO-GO reset button was then depressed at the P/G

5.13 The P/G and COUPLER POWER ON switch was depressed at the A/CO 100

5.14 The G&C SYSTEM POWER ON switch was depressed at the Startup Unit

5.15 HALT PRIME and DISABLE DESCRETES TRUE switches were turned off at the A/CO 100. The TIMER SPEEDUP INHIBIT switch was turned OFF at the A/CO 112.

5.16 At 8 minute the CALIBRATE button on the A/CO 100 was depressed.

5.17 The times of all events in the startup sequence were verified.

5.18 An accelerated startup using PROGRAM ADVANCE on the C-119, was then performed.

6. Test Summary

Sequence times were verified using a stopwatch. The following chart is a timing diagram showing times in the startup sequence.

7. General Information

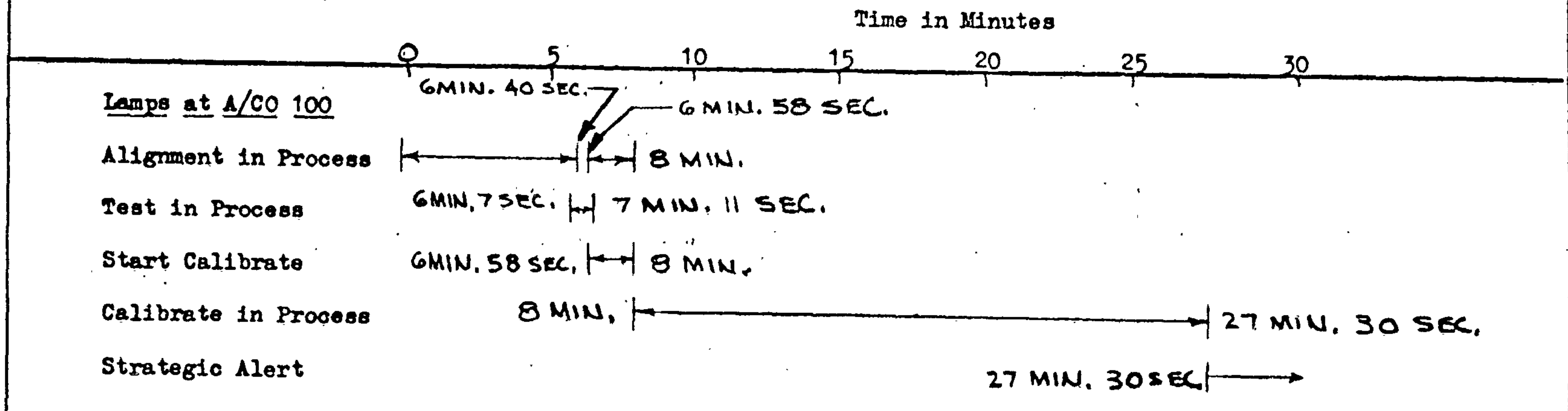
7.1 Test Engineer: Norman Noe

7.2 Date Test Complete: 16 October 1962

7.3 Change to EWA 8956

7.4 Applicable ER's None

TABLE 3.2.2.1-1



TIMING DIAGRAM - STARTUP SEQUENCE

TEST REPORT 3.2.2.2

1. <u>Test Title</u>

Programmer Group and Coupler Startup on LF Power System

2. <u>Objectives</u>

To establish a startup procedure when operating the P/G and coupler on the LF Power Subsystem.

3. <u>Conclusions</u>

This test verified the startup procedures for the Programmer Group and Coupler when operated on the LF Power Subsystem in the NRA.

4. <u>Equipment in Test</u>

4.1 Programmer Group, Figure A 1201, P/N 25-22036-68, S/N 0001

4.2 Coupler (C53C), Figure A 604, P/N 60950-305, S/N A0028

4.3 Distribution Box, P/N 25-23468-32, S/N 0003

4.4 Power Group, Figure A 1284, P/N 25-22552-36, S/N 0002

4.5 Motor Generator, Figure A 1283, P/N 10-20854-2, S/N 0001703

5. <u>Test Description</u>

5.1 All breakers to the P/G Coupler and Power Group were opened at the AC switch Panel.

5.2 The equipment was connected per Figure 3.2.2.2-2

5.3 All switches on the Launcher Auxiliary Simulator, Missile Simulator, LF Interface Simulator, Startup Unit and Coupler Test Set were placed in the OFF or Normal position.

5.4 At the AC switch Panel it was verified that the following lamps were on:

(a) P/G ON LF POWER GROUP

(b) COUPLER ON LF POWER GROUP

(c) LF POWER GROUP ON M-G SET

(d) MAIN POWER CONTROL

5.5 At the AC switch panel, it was verified that the following lamps were OFF:

(a) EMERGENCY POWER TEST

(b) POWER TEST OVERRIDE

(c) POWER TEST

5.6 The DISABLE DISCRETES TRUE and HALT PRIME switches were turned ON at the Startup Unit (A/CO 100).

5.7 The MASTER CONTROL switch on the LF Interface Simulators (A/CO 101) was placed in the LCF position.

5.8 The REMOTE/LOCAL switch on the A/CO 100 was placed in the REMOTE position.

5.9 Power to the P/G and Coupler was turned on by closing CB4, all breakers on the Power Group (except SCN/CTE and DPE) and CB1 and CB2 on the AC switch panel.

5.10 All BATE power switches were turned ON.

5.11 The MASTER CONTROL switch was placed back in the MANUAL position at the A/CO 101.

5.12 The C119 was turned ON.

5.13 The SHUT-DOWN SITE switch was depressed at the P/G, followed by the NO-GO reset.

5.14 System startup was then performed per test 3.2.2.1, paragraph 3.29.

6. Test Summary

This test verified startup procedure for the P/G and Coupler operating on the NRA LF Power Subsystem.

7. General Information

7.1 Test Engineer: Norman Noe

7.2 Date Test Complete: 25 October 1962

7.3 Change to EWA 8956

7.4 Applicable ER's None

TEST REPORT 3.2.2.3

1. Test Title

P/G and Coupler with H & D Power, VRSA Alarms and No-Go's.

2. Objectives

To verify compatibility of the P/G and Coupler with the H & D Power Subsystem.

3. Conclusions

Alarms initiated at the Launcher Auxiliary Simulator, LF Interface simulator and G & C Test Set were all reported properly by VRSA. No-Go's initiated at the Missile Downstage Simulator resulted in system shut-down. A list of alarm and No-Go's used in this test is included in this report (Table 3.2.2.3-1)

4. Equipment in Test

4.1 Programmer Group, Fig A1201, P/N 25-22036-68, S/N 0001.

4.2 Coupler (C53C), Fig A604, P/N 60950-305, S/N A0028.

4.3 Distribution Box, P/N 25-23468-32, S/N 0003

4.4 Power Group, Fig. A1284, P/N 25-22552-36, S/N 0002

4.5 Motor Generator, Fig. A1283, P/N 10-20884-2, S/N 001703

5. Test Description

5.1 The Programmer Group and Coupler were placed in Strategic Alert.

5.2 Alarm and No-Go's were initiated by activating the switches listed in Table 3.2.2.3-1. After the alarm lamp came on at the A/CO 100 and VRSA was interrogated, the alarm and VRSA were reset.

6. Test Summary

The alarms and No-Go's used in this test are listed in the following table:

TABLE 3.2.2.3-1

Alarm	Switch Location	VRSA Channel	Alarm Lamp	NO-GO Lamp
(a) Primary Power Alarm	Turn off 60~ to M-C Set	#21	ON	OFF
(b) Launch Tube Flood Alarm	Launcher Aux. Simulator	#18	ON	OFF
(c) Launcher Temperature Alarm	Launcher Aux. Simulator	#25	ON	OFF
(d) Equip. Inlet Air Humidity Alarm	Launcher Aux. Simulator	#24	ON	OFF
(e) Equip. Inlet Air Temp. & Flow Alarm	Launcher Aux. Simulator	#23	ON	OFF
(f) G & C Compartment Temp. Alarm	Launcher Aux. Simulator	#11	ON	OFF
(g) SCN Alarm #1(LSU Fault)	LF Interface Simulator	#28	OFF	OFF
(h) SCN Alarm #2(LSU Fault)	LF Interface Simulator	#29	OFF	OFF
(i) SCN Alarm #3(MD Fault)	LF Interface Simulator	#30	OFF	OFF
(j) SCN Alarm #4(MRU Fault)	LF Interface Simulator	#31	OFF	OFF
(k) SCN Alarm #5(LT Fault)	LF Interface Simulator	#32	OFF	OFF
(l) SCN Alarm #6(NT Fault)	LF Interface Simulator	#33	OFF	OFF
(m) Seismic Alarm	G & C Test Set	#22	OFF	OFF
(n) Autocollimator Alarm	G & C Test Set	#13	OFF	OFF
(o) Ord. Dev. Safe Inhibit NO-GO	Missile Downstage Simulator	#8	OFF	ON
(p) Warhead No-Go	Missile Downstage Simulator	#6	OFF	ON

TABLE 3.2.2.3-1 (Con't)

Alarm	Switch Location	VRSA Channel	Alarm Lamp	NO-GO Lamp
(q) R/v Arming & Fusing NO-GO	Missile Downstage Simulator	#7	OFF	ON
(r) G & C Compartment Temp NO-GO	Missile Downstage Simulator	#11	OFF	ON
(s) 400 Cycle Power Failure	AC Switch Panel	#1	OFF	OFF
(t) P/G Shutdown	Programmer Group	None	OFF	ON

7. General Information

7.1 Test Engineer: Norman Noe

7.2 Date Test Complete: 9 November 1962

7.3 Change to EWA 8956

7.4 Applicable ER's: None

TEST REPORT 3.2.2 .4

1. Test Title

Programmer Group and Coupler with H&D Power, Test Sequence from Strategic Alert.

2. Objective

To verify compatibility of the P/G and Coupler with the NRA H&D Power Subsystem.

3. Conclusions

After the incorporation of ECP 263, the Programmer Group and Coupler successfully completed tests from strategic alert. Prior to the installation of ECP 263, several intermittent No-Go's occured during the emergency power test. ECP 263 corrected the problem and made the NRA H&D Power Subsystem compatible with the P/G and Coupler during the test sequence. (See Paragraph 6.1)

Table 3.2.2.4-1 is a timing diagram showing the sequence of selected P/G and Coupler interface signals. All times were in agreement with those given in the P/G model specifications, D2-13436.

4. Equipment In Test

4.1 Programmer Group, Figure A 1201, P/N 25-22036-68, S/N 0001

4.2 Coupler (C53C), Figure A 604, P/N 60950-305, S/N A0028

4.3 Distribution Box, P/N 25-23468-32, S/N 0003

4.4 Power Group, Figure A 1284, P/N 25-22552-36, S/N 0002

4.5 Motor Generator, Figure A 1283, P/N 10-20884-2, S/N 0001703

5. Test Description

5.1 The system was placed in Strategic Alert per test 3.2.2.2

5.2 A test sequence was initiated from the A/CO 100 by depressing the Test Command button.

5.3 Selected interface signals were recorded during the sequence

6. Test Summary

6.1 In order to perform this test successfully, it was necessary to incorporate ECP 263 into the Motor Generator Set (Figure A 1283). ECP 263 placed diodes across the brush lifting solenoids. Without the diodes, voltage transients were being introduced into the system, causing shut-downs when the system transferred to emergency power.

6.2 The P/G output signal, Ignite First Stage Engine, does not appear on the oscillograph records made during Test, due to incorrect gain settings in the instrumentation. This signal is approximately 90 mv in magnitude and 4 ms in duration, and occurs at count 28. It was observed with an oscilloscope after the oscillograph recordings were made.

7. General Information

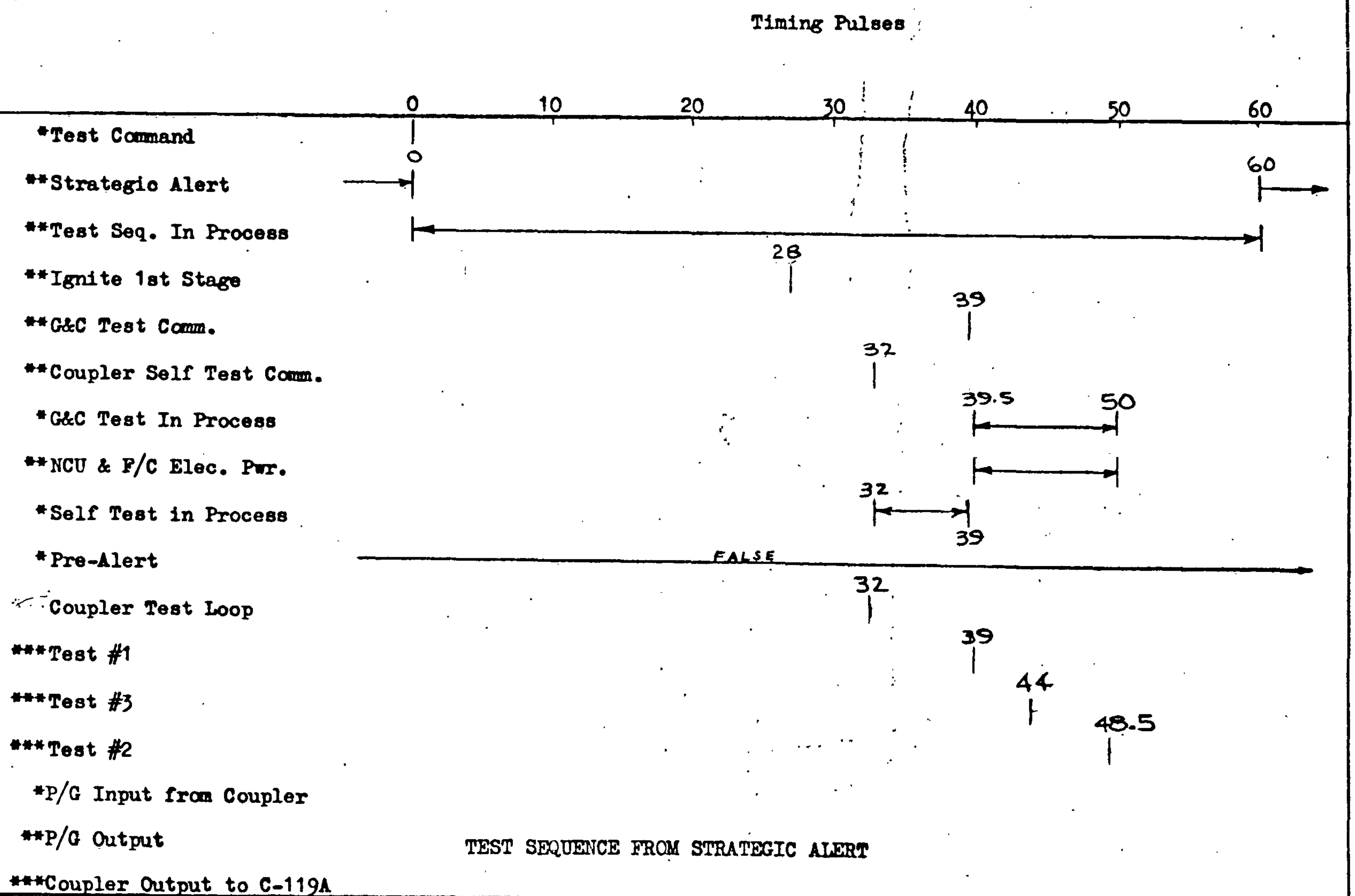
7.1 Test Engineer: Norman Noe

7.2 Date Test Complete: 29 October 1962

7.3 Charge to EWA 8956

7.4 Applicable ER's: None

TABLE 3.2.2.4-1



TEST SEQUENCE FROM STRATEGIC ALERT

TEST REPORT 3.2.2.5

1. Test Title

Programmer Group and Coupler with H & D Power, Calibrate Sequence

2. Objective

To verify compatibility of the P/G and Coupler with the H & D Power Subsystem.

3. Conclusions

The Programmer Group and Coupler successfully completed the Calibrate Sequence while operating on the NRA H & D Power Subsystem. The sequence was run with fast P/G timing (8 times faster than normal) and required 19.1 minutes. Oscillograph records show that the correct command was issued to the simulated D17 computer from the Coupler upon receipt of the Calibrate Command from the P/G.

4. Equipment in Test

4.1 Programmer Group, Fig. A1201, P/N 25-22036-18, S/N0001

4.2 Coupler (C53C), Fig A604, P/N 60950-305, S/N A0028

4.3 Distribution Box, P/N 25-23468-32, S/N 0003

4.4 Power Group, Fig A1284, P/N 25-22557-36, S/N 0002

4.5 Motor Generator, Fig A 1283, P/N 10-20884-2, S/N 0001703

5. Test Description

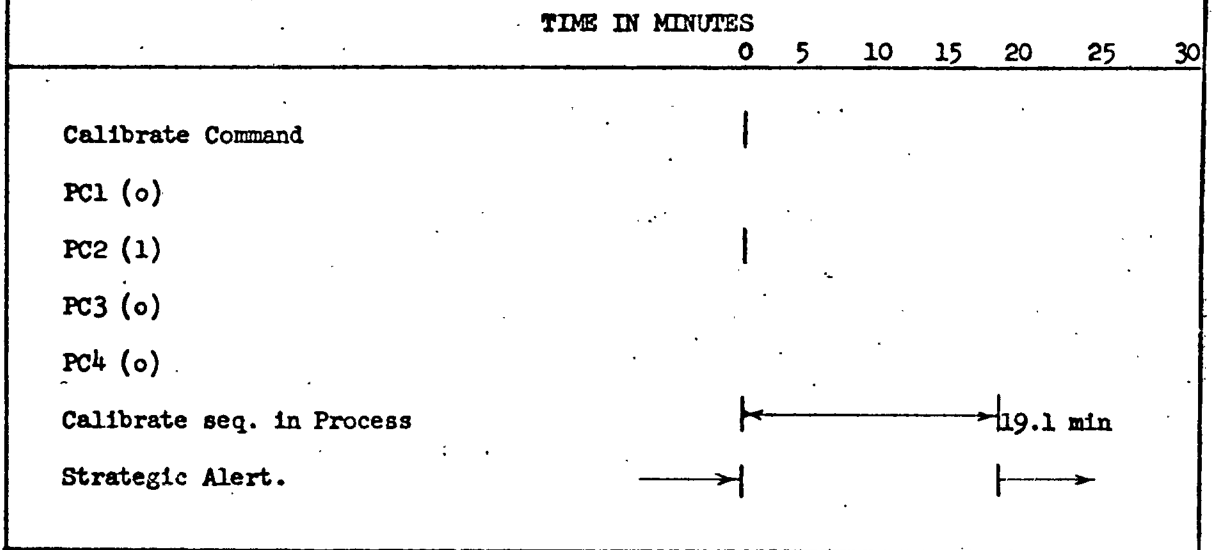
5.1 The system was placed in a Strategic Alert Mode per par. 3.2.9 of 3.2.2.2

5.2 The Calibrate button on the Startup Unit (A/C0100) was depressed. P/G interface signals were recorded at 7.5 ips with the NRA instrumentation system.

6. Test Summary

The P/G Calibrate Command, Coupler Calibrate Command to the simulated D17 computer (C-119A) and calibrate in Process signal from the P/G were recorded on tape. The Timer Speed-up Inhibit switch on the A/CO 112 was OFF. The length of the Calibrate required is shown in the following timing diagram (Table 3.2.2.5-1)

TABLE 3.2.2.5-1



CALIBRATE SEQUENCE FROM STRATEGIC ALERT
(With P/G Timing Speed-up)

7. General Information

7.1 Test Engineer: Norman Noe

7.2 Date Test Complete: 31 October 1962

7.3 Change to EWA 8956

7.4 Applicable ER's: None

Test Report 3.2.2.6

1. Test Title

P/G and Coupler with H & D Power, Pre-Alert NO-GO's, Sequence Errors, Test and Calibrate Tests.

2. Objective

To verify compatibility of the P/G and Coupler with the H & D Power Subsystem.

3. Conclusions

The Programmer Group and Coupler responded properly to Pre-Alert NO-GO's, Sequence Errors and out of sequence commands. System response was as follows:

3.1 An Ordnance Devices Safe, G & C Compartment Temperature, Re-entry Vehicle Arming and Fusing or Warhead NO-GO during the alignment Mode (while the Coupler is in Pre-Alert "A") will result in system shut-down.

3.2 A Sequence Error during Alignment Mode (Pre-Alert A) will cause a G & C Error signal to be issued to the P/G. With a G & C Error, the system does not complete the alignment sequence.

3.3 A Sequence Error prior to or during the Coupler Self Test portion of Test will cause a G & C Error, Coupler NO-GO, and system shut down. A Sequence Error during G & C Self Test causes a G & C Error and failure of Test (The P/G does not issue Start Calibrate), but no system shut-down.

3.4 During the Calibrate Sequence (Coupler in Pre-Alert A) a Sequence Error will cause a G & C Error to be issued by the Coupler. The system does not complete the Calibrate sequence and go into Strategic Alert.

3.5 When the P/G and Coupler are in an Alignment, Test, or Calibrate Mode, Test or Calibrate commands have no effect on the status of the equipment.

4. Equipment in Test

4.1 Programmer Group, Fig. A1201, P/N 25-22036-68, S/N 0001

4.2 Coupler (C53C), Fig. A604, P/N60950-305, S/N A0028

4.3 Distribution Box, P/N 25-23468-32, S/N 0003

4.4 Power Group, Fig A1284, P/N 25-22552-36, S/N 0002

4.5 Motor Generator, Fig A1283, P/N 10-20884-2, S/N 0001703

5. Test Description

5.1 The system was placed in Strategic Alert per test 3.2.2.2. At the A/CO 100 the Disable Discrete and Halt Prime switches were made momentarily true and then placed back in false position to place the system into the Alignment mode.

5.2 No-GO's were initiated from the A/CO 114 and system response noted.

5.3 With the system in alignment, Sequence Errors were initiated from the C-119 (Coupler Test Set)

5.4 The system was placed into Test and Sequence Errors initiated during the First part of Test (before Coupler Self-Test)

5.5 Sequence Errors were then initiated during the G & C Self-Test portion of Test.

5.6 The system was then placed into Calibrate and the same sequence errors initiated from the C-119.

5.7 Test and Calibrate commands were issued during the Alignment, Test, and Calibrate sequences and response was noted.

6. Test Summary

6.1 The No-Go's initiated in part 5.2 were:

(a) Ordnance Devises Safe Inhibit N/G

(b) Warhead N/G

6.1 (c) Re-entry Vehicle Arming and Fusing N/G

(d) G & C Compartment Temp. N/G

6.2 The sequence errors used in parts 5.3 through 5.6 were:

(a) Confirm Codes

(b) Parity Error

(c) Sequence Advance Error

(d) Downstage No-Go

7. General Information

7.1 Test Engineer: Norman Noe

7.2 Date Test Complete: 8 November 1962

7.3 Change to EWA 8956

7.4 Applicable ER's: None

TEST REPORT 3.2.2.7

1. Title

Programmer Group and Coupler with H&D Power, Emergency Alert Tests.

2. Objective

To verify compatibility of the P/G and Coupler with the NRA H&D Power Subsystem.

3. Conclusions

3.1 The Programmer Group and Coupler completed a Test Sequence under Emergency Alert Conditions (Autocollimator Alarm present). Sequence times are shown on Table 3.2.2.7-1.

3.2 The Programmer Group would not initiate a Calibrate Sequence with a true Autocollimator Alarm input. (Reference paragraph 3.4.5 of Model Specification D2-13436).

3.3 A Launch Sequence was successfully completed with an Autocollimator Alarm present. Table 3.2.2.7-1 includes Launch Event times obtained from the oscillograph recorder made during the test.

3.4 With an Autocollimator Alarm and fast P/G timing (eight times normal), a NO-GO shut-down was obtained after 45 minutes.

4. Equipment in Test

4.1 Programmer Group, Figure A 1201, P/N 25-22036-68, S/N 0001

4.2 Coupler, Figure A 604, P/N 60950-305, S/N A0028

4.3 Distribution Box, P/N 25-23468-32, S/N 0003

4.4 Power Group, Figure A 1284, P/N 25-22552-36, S/N 0002

4.5 Motor Generator, Figure A 1283, P/N 10-20884-2, S/N 0001703

5. Test Description

5.1 They system was placed in Strategic Alert per Test 3.2.2.2.

5.2 An Autocollimator Alarm is initiated by placing the AC #1 and AC #2 switches on the Coupler Test Set (C-119) to the ON position.

5.3 After the Alarm lamp came on at the Startup Unit (A/CO 100) the Test Command button at the A/CO 100 is depressed. Interface signals were recorded during the Test Sequence.

5.4 After the Strategic Alert lamp came on at the A/CO 100, the Calibrate Command button was depressed.

5.5 A Launch Sequence was then performed with the Autocollimator Alarm still present.

5.6 After the Launch Sequence, the system was again placed in Strategic Alert and another Autocollimator Alarm initiated. The Timer Speedup Inhibit switch at the A/CO 112 was placed in the OFF position. NO-GO shut-down after 45 minutes was verified.

6. Test Summary

6.1 Table 3.2.2.7-1 is a timing chart showing sequence times for Test and Launch. This information was taken from the oscillograph records made in this test.

6.2 Channel four on the Launch record shows the G&C Power Off command. The command is true during count 11. Instead of cutting off abruptly at the beginning of count 12, the signal decays exponentially to a 0 volt level in approximately 6 seconds. The failure of the signal to cut off abruptly does not effect the operation of the system during launch. During the one second that the signal is true, the trip coil

5. Test Description

5.1 The system was placed in Strategic Alert per Test 3.2.2.2.

5.2 An Autocollimator Alarm is initiated by placing the AC #1 and AC #2 switches on the Coupler Test Set (C-119) to the ON position.

5.3 After the Alarm lamp came on at the Startup Unit (A/CO 100) the Test Command button at the A/CO 100 is depressed. Interface signals were recorded during the Test Sequence.

5.4 After the Strategic Alert lamp came on at the A/CO 100, the Calibrate Command button was depressed.

5.5 A Launch Sequence was then performed with the Autocollimator Alarm still present.

5.6 After the Launch Sequence, the system was again placed in Strategic Alert and another Autocollimator Alarm initiated. The Timer Speedup Inhibit switch at the A/CO 112 was placed in the OFF position. NO-GO shut-down after 45 minutes was verified.

6. Test Summary

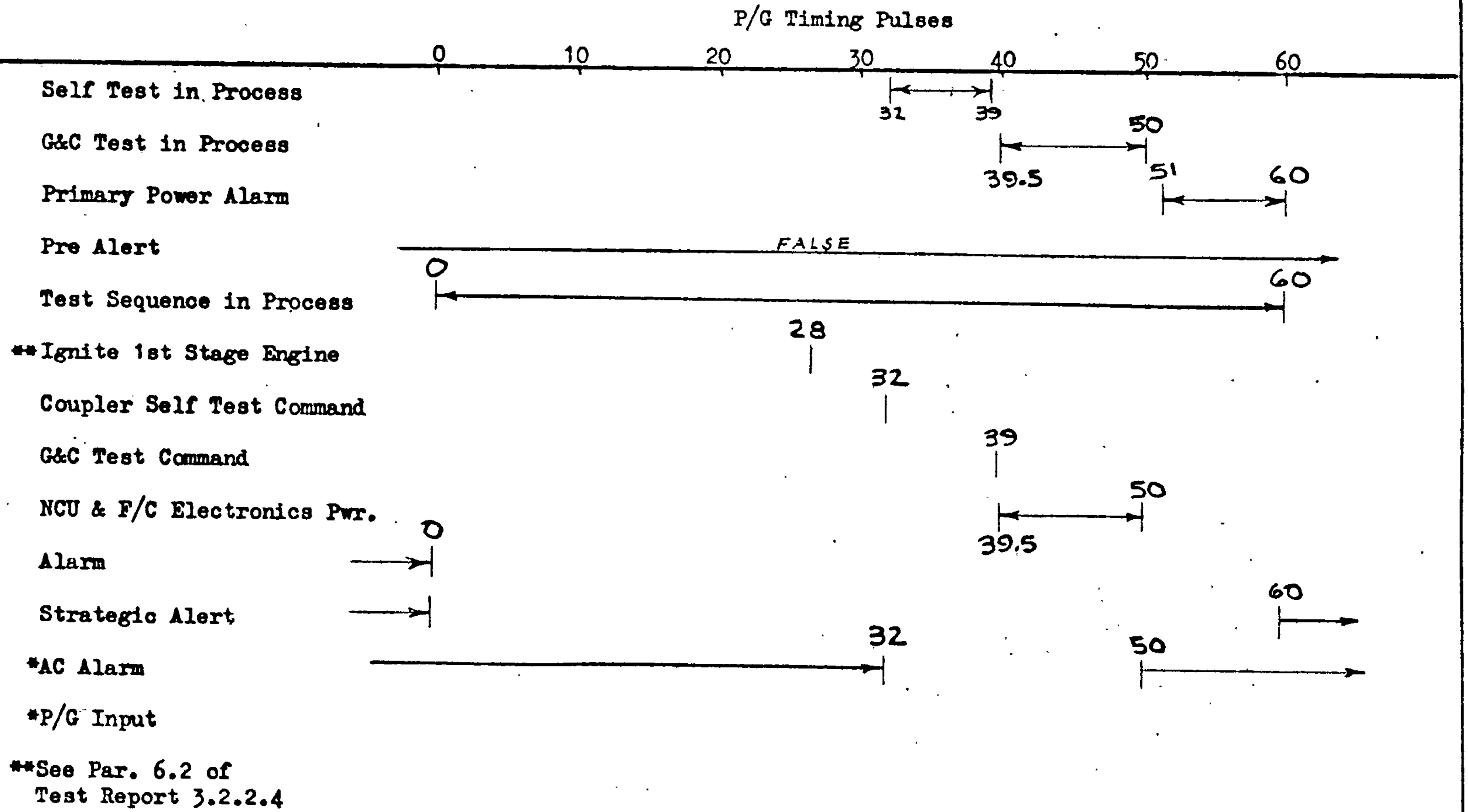
6.1 Table 3.2.2.7-1 is a timing chart showing sequence times for Test and Launch. This information was taken from the oscillograph records made in this test.

6.2 Channel four on the Launch record shows the G&C Power Off command. The command is true during count 11. Instead of cutting off abruptly at the beginning of count 12, the signal decays exponentially to a 0 volt level in approximately 6 seconds. The failure of the signal to cut off abruptly does not effect the operation of the system during launch. During the one second that the signal is true, the trip coil

at relay K1 in the Distribution Box is actuated, opening the K1 relay. The signal passes through the closed contacts of K1, so that as soon as the trip coil is actuated, the P/G power Off Command output is open-circuited.

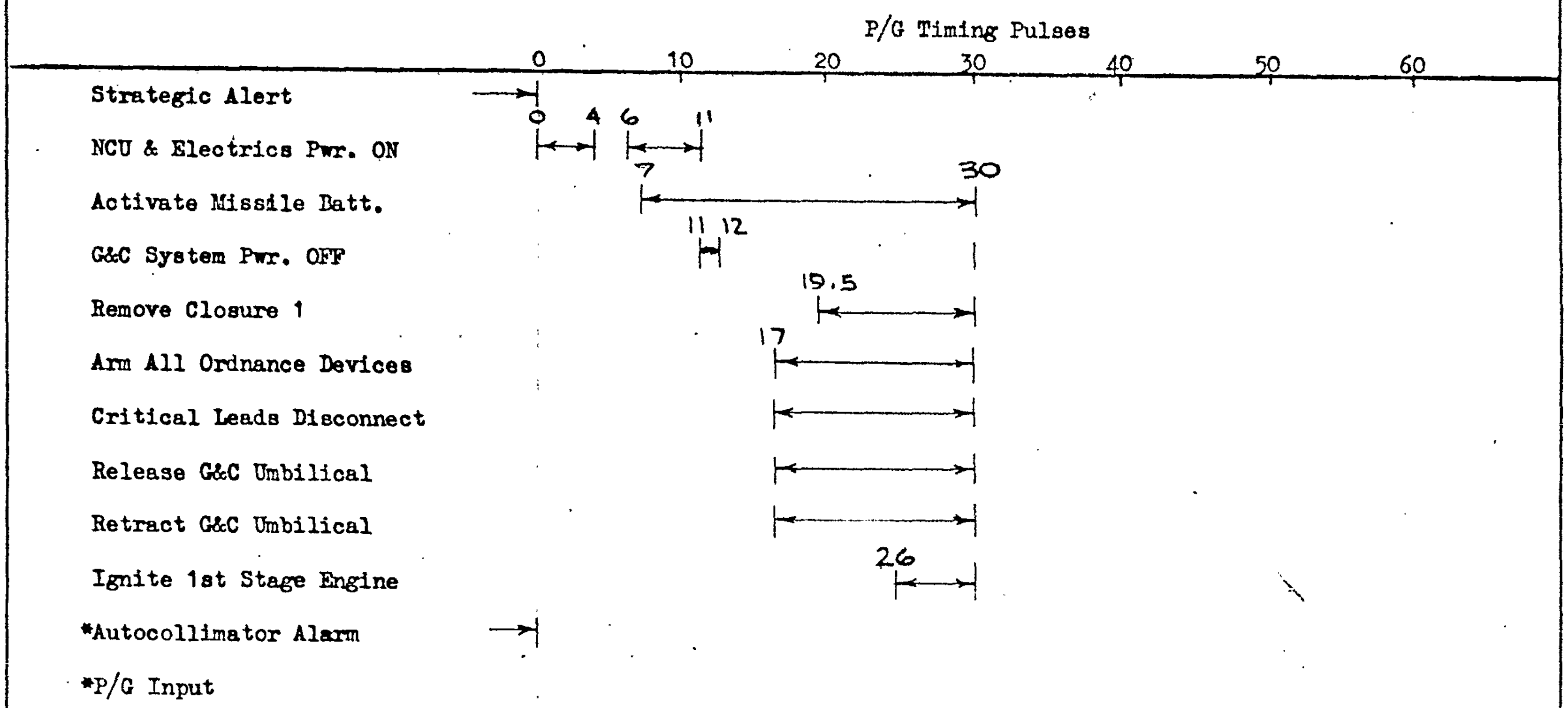
6.3 The Ignite First Stage Engine signal on Channel #13 came true at the proper time, but its magnitude appears to be less than 28 volts on the oscillograph record. This was due to an instrumentation error, as later investigation verified that the signal was 28 volts at the P/G interface.

TABLE 3.2.2.7-1



TIMING DIAGRAM - TEST FROM EMERGENCY ALERT

TABLE 3.2.2.7-2



TIMING DIAGRAM - LAUNCH FROM EMERGENCY ALERT

Test Report 3.2.2.8

1. Test Title

Programmer Group and Coupler with H & D Power, Launch Sequence

2. Objective

To verify compatibility of the Programmer and Coupler with the H & D power subsystem.

3. Conclusions

3.1 The Programmer Group and Coupler successfully completed launch sequences when operating on the NRA H & D power subsystem. Events in the launch sequence were recorded on the NRA instrumentation system and on the ACO 372 Launch Event Recorder. Table 3.2.2.8-1 is a timing chart, illustrating the data taken from the recordings.

3.2 Table 3.2.2.8-1 agrees with the launch timing diagram given in the P/G Model Specification D2-13436, with one exception. The model specification shows the P/G output signal, Remove closure, occuring at count 19, before the output signals, Arm all Ordnance Devices, Critical Leads Disconnect, Release G & C Umbilical, and Retract G & C Umbilical. The test recording shows these signals occuring before Remove Closure. The difference in the timing of these events is due to the C-119 coupler test set, which is used to simulate the D-17 Airborne Computer. The P/G issues the commands to Arm All Ordnance Devices, Disconnect Critical Leads, Release G & C Umbilical and Retract G & C Umbilical when Flight Program Entered is received from the C-119. This signal may occur from 16.2 to 19.5 seconds after the beginning of launch. Remove closure occurs at count 19 as it should, but the other four signals come true at count 17 instead of count 19.5 as indicated in the P/G Model Specification Timing diagram.

4. Equipment in Test

4.1 Programmer Group, Fig. A1201, P/N 25-22036-68, S/N 0001

4.2 Coupler (C53C), Fig. A604, P/N 60950-305, S/N A0028

4.3 Distribution Box, P/N 25-23468-32, S/N 0002

4.4 Power Group, Fig. A1284, P/N 25-22552-36, S/N 0002

4.5 Motor Generator, Fig. A1283, P/N 10-20884-2, S/N 0001703

5. Test Description

5.1 The Programmer Group and Coupler were placed in a Strategic Alert status.

5.2 The Timer Speedup inhibit switch was placed to ON and the SCS armed by removing cable W529 (J27)

5.3 A launch was initiated and selected interface signals from the P/G recorded with the NRA instrumentation system.

6. Test Summary

Output signals from the P/G were monitored by means of a breakout box. Signals were recorded on tape at 60 ips and played back at 7.5 ips onto an oscillograph. Oscillograph records are on file in the NRA Laboratory.

7. General Information

7.1 Test Engineer: Norman Noe

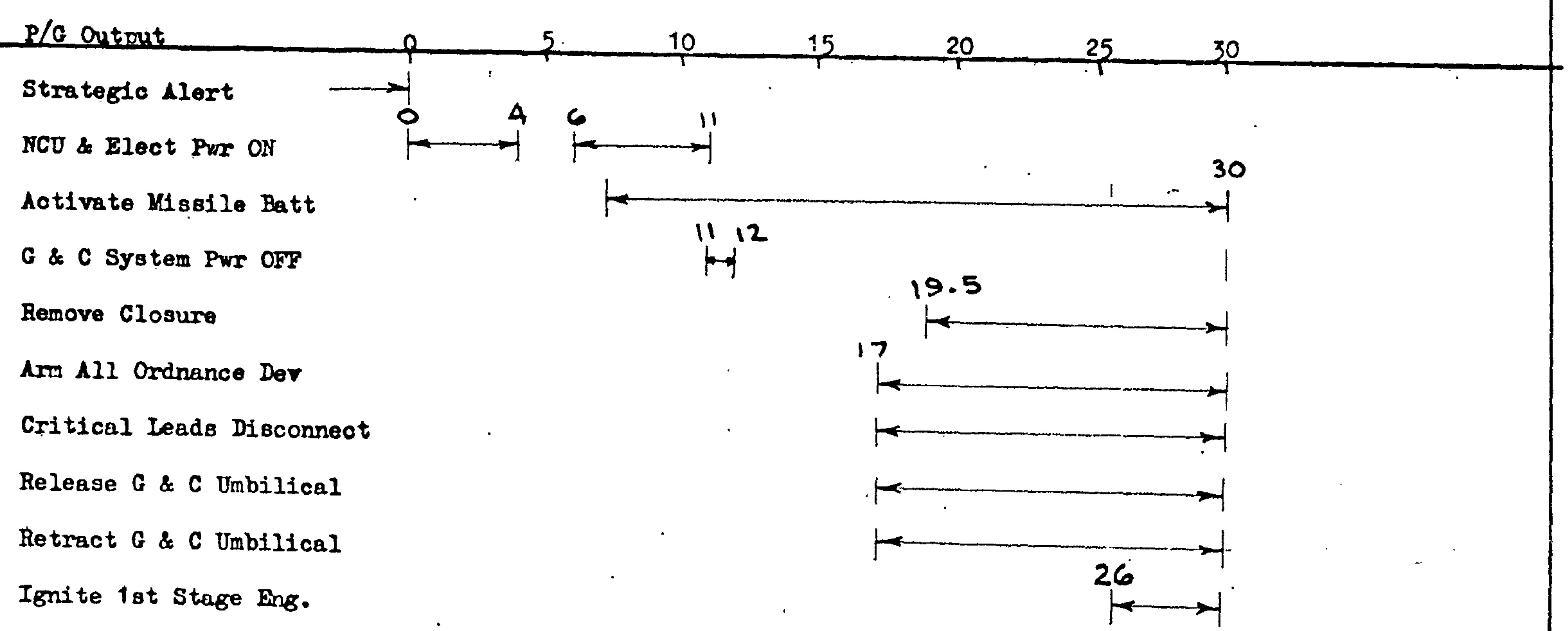
7.2 Date Test Complete: 2 November 1962

7.3 Change to EWA 8956

7.4 Applicable ER's None

TABLE 3.2.2.8-1

Timing Pulses



LAUNCH SEQUENCE TIMING DIAGRAM

TEST REPORT 3.2.2.9

1. Title

Programmer Group and Coupler with H&D Power, Sequence Errors during Stragegic Alert.

2. Objective

To verify compatibility of the P/G and Coupler with the H&D Power Subsystem.

3. Conclusions

3.1 The Coupler and Programmer Group responded properly to Sequence Errors during Strategic Alert, Calibrate Sequence from Strategic Alert, and Test Sequence from Strategic Alert. System response was as follows:

(a) A Premature Sequence Advance, Confirm Codes Error, Parity Error, or Downstage NO-GO issued from the C-119A caused the Coupler to enter Pre-alert B and the Programmer Group to command a re-start. On the fifth re-start the P/G commanded a system shut-down.

(b) When the Calibrate Sequence was entered from Strategic Alert, (Mode A4) flip-flop M_1 in the Coupler remained set throughout the sequence, and Pre-alert B was not entered until a Sequence Error was detected.

(c) During a test from Strategic Alert, the Coupler commanded a re-start when a Sequence Error was detected.

3.2 The Programmer Group and Coupler had the correct response to Sequence Errors during the alignment portion of Pre-alert B (re-start). A Sequence Error caused the Coupler to issue a G&C NO-GO for Confirm Codes, Parity Error and Premature Sequence Advance, and a Downstage NO-GO for a Downstage NO-GO Code. The P/G shut down the system upon receipt of the G&C NO-GO and Downstage NO-GO commands from the Coupler.

4. Equipment in Test

4.1 Programmer Group, Figure A 1201, P/N 25-22036-68

4.2 Coupler (C53C), Figure A 604, P/N 60950-305

4.3 Distribution Box, P/N 25-23468-32, S/N 0002

4.4 Power Group, Figure A 1284, P/N 25-22552-36, S/N 0002

4.5 Motor Generator, Figure A 1283, P/N 10-20884-2, S/N 0001203

5. Test Description

5.1 The system was brought up to Strategic Alert per Test 3.2.2.2

5.2 The Local/Remote switch at the A/CO 101 was placed to remote

5.3 The Sequence Advance Error switch at the Coupler Test Set (C-119A) was activated until the Disable Discretes lamp came on at the G&C Test Set, and then returned to NORMAL position immediately. The Program Advance switch was then activated during the Alignment and Calibrate portions of the re-start to bring the P/G and Coupler back up to Strategic Alert.

5.4 Paragraph 5.2 was repeated for Parity Error, Confirm Codes Error, and Downstage NO-GO. Some difficulty was experienced in using the Downstage NO-GO switch (see Test Summary for details).

5.5 The P/G and Coupler were again brought up to Strategic Alert. The Downstage NO-GO switch was activated until Disable Discretes came true at the Coupler Test Set, and then placed back in NORMAL position. The switch was activated again when the Alignment lamp came on at the A/CO 100.

5.6 Paragraph 5.4 was repeated for the other Sequence Errors (Parity, Confirm Codes, and Sequence Advance)

5.6 The system was then placed in Strategic Alert and a test commanded. The four Sequence Errors were then initiated by activating the appropriate switch on the Coupler Test Set until the Disable Discretes lamp illuminated. After each error, the system was brought up to Strategic Alert and a test commanded before the next sequence error was initiated.

5.7 Paragraph 5.6 was repeated for Calibrate from Strategic Alert.

6. Test Summary

In order to generate a Sequence Error using the Downstage NO-GO switch on the C-119A, it is necessary to operate the switch rapidly or a Downstage NO-GO will result. This is due to the fact that the Downstage NO-GO code is being issued with every timing pulse (every 33 ms) as long as the switch is in Test position. When the Downstage NO-GO Code is first detected, a Coupler Reset R_1 is issued which resets the Mode Memory flip-flops to produce the Align Mode in the Coupler. R_1 resets and starts the Reset timer countdown chain running. Approximately 2 ms later Master Reset is sent to the C-119A. Master Reset remains true for 33 ms, and while it is true the Downstage NO-GO Code from the C-119A is inhibited. When Master Reset is removed, the Downstage NO-GO code is again sent to the Coupler, which by this time is in Pre-Alert B. The Code is detected as a Sequence Error in Pre-Alert B. Therefore, the switch must be turned OFF while Master Reset is still true or as it goes false, or a shutdown will result.

7. General Information

7.1 Test Engineer: Norman Noe

7.2 Date Test Complete: 27 November 1962

7.3 Charged to EWA 8956

7.4 Applicable ER's: None

TEST REPORT 3.2.2.10

1. Test Title

Programmer Group and Coupler with H&D Power, Pre-Flight Mode Alarms, NO-GO's, and Sequence Errors.

2. Objectives

To verify compatibility of the P/G and Coupler with the H&D Power Subsystem.

3. Conclusions

The Programmer Group and Coupler responded properly to the Alarm, NO-GO's and Sequence Errors initiated just prior to launch. Table 3.2.2.10-1 lists the conditions used and the observed system response.

4. Equipment In Test

4.1 Programmer Group, Figure A 1201, P/N 25-22036-68, S/N 0001

4.2 Coupler (C53C), Figure A 604, P/N 60950-305, S/N A0028

4.3 Distribution Box, P/N 25-23408-32, S/N 0003

4.4 Power Group, Figure A 1284, P/N 25-22552-36, S/N 0002

4.5 Motor Generator, Figure A 1283, P/N 10-20884-2, S/N 0001703

5. Test Description

5.1 The system was placed in Strategic Alert per test 3.2.2.2 for each part of the test.

5.2 Alarms were initiated per test 3.2.2.3, followed by a Launch Command, after each launch was completed the alarm was removed and the system started up to Strategic Alert.

5.3 NO-GO's were initiated at the A/CO 114, followed by Launch Commands.

6. Test Summary

The results of this test are summarized in Table 3.2.2.10-1.

7. General Information

7.1 Test Engineer: Norman Noe

7.2 Date Test Complete: 14 November 1962

7.3 Charge to EWA 8956

7.4 Applicable ER's: None

TABLE 3.2.2.10-1

Fault	Observation
Primary Power Alarm	Launch Completed
Launch Tube Flood Alarm	
Equipment Inlet Air Humidity Alarm	
Launcher Temperature Alarm	
Equipment Inlet Air Temperature and Flow Alarm	
Seismic Alarm	
Autocollimotor Alarm	
G&C Compartment Temperature Alarm	Launch Completed
Ordnance Device Safe Inhibit	No-Go Shut-Down
W/H No-Go	
R/V Arming and Fusing No-Go	No-Go shut-down
Umbilical Release Inhibit (at Missile Downstage Simulator)	Launch Completed
Arm Ordnance Devices Inhibit	No-Go shut-down within 30 seconds
Sequence Advance Error	No-Go shut-down
Confirm Codes Error	
Parity Error	
Downstage No-Go	No-Go shut-down

TEST REPORT 3.2.2.11

1. Test Title

Programmer Group and Coupler with H&D Power, Post Flight No-Go's and Sequence Errors.

2. Objective

To verify compatibility of the Programmer Group and Coupler with the H&D Power Subsystem.

3. Conclusions

3.1 The Programmer Group's response to No-Go's initiated after the beginning of the launch sequence was as specified in section 3.4.3 of D2-13436 (P/G Model Specification). After Flight Program Entered, the Ordnance Device Safe, W/H Safe, and R/V Arming and Fusing No-Go's are inhibited. The G&C Compartment Temperature No-Go is inhibited during the entire launch sequence. The Arm Ordnance Device Inhibit No-Go prevents First Stage Ignition from coming true, resulting in a system shut-down at the end of the launch timer run-out.

3.2 When Flight Program Entered comes true from the computer (C-119), two gates are disabled in the Coupler which prevent No-Go's from being sent to the P/G. Therefore, the sequence errors initiated after Flight Program Entered had no effect on the Launch Sequence. This was the currect Programmer Group response.

4. Equipment in Test

4.1 Programmer Group, Figure A 1201, P/N 25-22036-68, S/N 001

4.2 Coupler (C53C), Figure A 604, P/N 60950-305, S/N A0028

4.3 Distribution Box, P/N 25-23468-32, S/N 0003

4.4 Power Group, Figure A 1284, P/N 25-22552-36, S/N 0002

4.5 Motor Generator, Figure A 1283, P/N 10-20884-2, S/N 0001703

5. Test Description

5.1 The system was placed in Strategic Alert per test 3.2.2.2

5.2 Launch Sequences were initiated per test 3.2.2.8. When the Armed Ordnance Devices lamp (indicating Flight Program Entered) illuminated, No-Go's or Sequence Errors were initiated per Table 3.2.2.11-1 and system response noted.

6. Test Summary

The results of the test are summarized in Table 3.2.2.11-1.

7. General Information

7.1 Test Engineer: Norman Noe

7.2 Date Test Complete: 14 November 1962

7.3 Charge to EWA 8956

7.4 Applicable ER's: None

TABLE 3.2.2.11-1

Location	Fault	Result
A/CO 114	Ordnance Devices Safe Inhibit	Launch Completed
A/CO 114	W/H No-Go	
A/CO 114	R/V Arming and Fusing No-Go	
Launcher Aux. Simulator	G&C Compartment Temperature No-Go (Launcher Auxiliary Simulator)	Launch Completed
A/CO 114	Arm Ordnance Devices Inhibit	No-Go Shut-Down
P/G	P/G Shut-Down	No-Go Shut-Down
C-119A	Sequence Advance Error	Launch Completed
C-119A	Confirm Codes	
C-119A	Parity Error	
C-119A	Downstage No-Go	Launch Completed

TEST REPORT 3.2.2.12

1. Test Title

Programmer Group and Coupler with H&D Power, Command Interactions.

2. Objective

To verify compatibility of the P/G and Coupler with H&D Power Subsystem.

3. Conclusions

3.1 The Programmer Group's response to test and calibrate commands during Launch, Launch Commands during Test and Calibrate, and Launch from Pre-alert B was as specified in D2-13436. The Test and Calibrate commands during launch had no effect on the Launch Sequence. A Launch Command during Calibrate had no effect on the Calibrate Sequence. A Launch Command during Test caused a Launch Sequence to be initiated after the Emergency Power Test portion of the sequence.

3.2 It was also verified in this test that a Launch cannot be initiated with the SCS switch in the Distribution Box in Safe position.

4. Equipment In Test

4.1 Programmer Group, Figure A 1201, P/N 25-22036-68, S/N 0001

4.2 Coupler (C53C), Figure A 604, P/N 60950-305, S/N A0028

4.3 Distribution Box, P/N 25-23468-32, S/N 0003

4.4 Power Group, Figure A 1284, P/N 25-22552-36, S/N 0002

4.5 Motor Generator, Figure A 1283, P/N 10-20884-2, S/N 0001703

5. Test Description

5.1 The system was placed in Strategic Alert per test 3.2.2.2.

5.2 A Launch Sequence was initiated, followed by a Test Command.

5.3 The system was brought up to Strategic Alert and another Launch initiated, followed by a Calibrate Command.

5. Test Description (Cont'd)

5.4 The system was brought up to Strategic Alert and then placed into the Pre-alert B mode by initiating a Sequence Error (confirm codes). A Launch Command was then initiated.

5.5 A test command was initiated, followed by a Launch Command.

5.6 5.5 was repeated for Calibrate Command

5.7 The SCS switch in the Distribution Box was locked in the Safe position and a launch attempted.

6. Test Summary

Test results are summarized in Table 3.2.2.12-1.

7. General Information

7.1 Test Engineer: Norman Noe

7.2 Date Test Complete: 14 November 1962

7.3 Charge to EWA 8956

7.4 Applicable ER's: None

TABLE 3.2.2.12-1

Mode	Command	Result
Flight	Test	System not affected, Launch continues
Flight	Calibrate	System not affected, Launch continues
Alignment-Pre-Alert B	Launch	System not affected, startup continues
Test from Strategic Alert	Launch	System enters Launch mode after transferring to Emergency Power
Calibrate from Strategic Alert	Launch	System not affected, Calibrate continues
Strategic Alert switch SCS in Safe position	Launch	System not affected, launch sequence not initiated.

TEST REPORT 3.2.2.13

1. Test Title

Programmer Group and Coupler with H&D Power, Site Shut-Down

2. Objective

To verify shut-down procedures for the P/G and Coupler operating on NRA H&D Power

3. Conclusions

This test verified system shut-down procedures for the P/G, Coupler, VRSA and BATE Gear.

4. Equipment In Test

4.1 Programmer Group, Figure A 1201, P/N 25-22036-68, S/N 0001

4.2 Coupler, Figure A 604, P/N 60950-305, S/N A0028

4.3 Distribution Box, P/N 25-23468-32, S/N 0003

4.4 Power Group, Figure A 1284, P/N 25-22552-36, S/N 0002

4.5 Motor Generator, Figure A 1283, P/N 10-20884-2, S/N 0001703

5. Test Description

5.1 The Remote/Local switch at the Startup Unit (A/CO 100) was placed to Local.

5.2 The Site Shut-Down button was depressed at the A/CO 100

5.3 Circuit Breaker CB1 and CB2 were opened at the AC Switch Panel

5.4 All breakers on the front of the LF Power Group were opened.

5.5 Circuit Breaker CB4 was opened at the AC Switch Panel.

5.6 Power switches on the Startup Unit, LF Interface Simulator, Missile Downstage Simulator, Launcher Auxiliary Simulator and G&C Coupler Test Set.

5.7 All breakers on the Main Distribution Box were opened.

6. Test Summary

Shut-down procedures were verified in the test log.

7. General Information

7.1 Test Engineer: Norman Noe

7.2 Date Test Complete: 16 November 1962

7.3 Charge to EWA 8956

7.4 Applicable ER's: None

TEST REPORT 3.2.2.14

1. Title

Programmer Group and Coupler with H&D Power, Emergency Power Tests.

2. Objective

To verify compatibility of the P/G and Coupler with the H&D Power Subsystem.

3. Conclusion

3.1 The Programmer Group and Coupler completed a Calibrate Sequence while operating on Emergency Power. The sequence required 19.1 minutes to complete with fast P/G timing (eight times normal). The sequence is shown on Timing Chart 3.2.2.14-1. The Mode Control lines to the simulated computer (C119A) were monitored on tape, and the correct Calibrate Command (0100) from the Coupler is shown on the oscillograph record made from the tape.

3.2 The Programmer Group and Coupler completed a Launch Sequence on Emergency Power. As in Test 3.2.2.8, Arm all Ordnance Devices, Critical Leads Disconnect, Release G&C Umbilical, and Retract G&C Umbilical occured before Remove Closure, due to the Flight Program Entered input becoming true sooner than normal (See Test 3.2.2.8).

4. Equipment in Test

4.1 Programmer Group, Figure A 1201, P/N 25-22036-68, S/N 0001

4.2 Coupler (C53C), Figure A 604, P/N 60950-305, S/N A0028

4.3 Distribution Box, P/N 25-23468-32, S/N 0003

4.4 Power Group, Figure A 1284, P/N 10-20884-2, S/N 0001703

5. Test Description

5.1 The system was placed in Strategic Alert per Test 3.2.2.2

5.2 The 60 cycle breakers to the LF M-C Set were opened to transfer the system to emergency power (battery operation)

5.3 The Calibrate Command button was depressed at the Startup Unit (A/CO 100) to put the system into a Calibrate Sequence. Selected interface signals were recorded during the sequence. The Timer Speedup Inhibit switch was OFF.

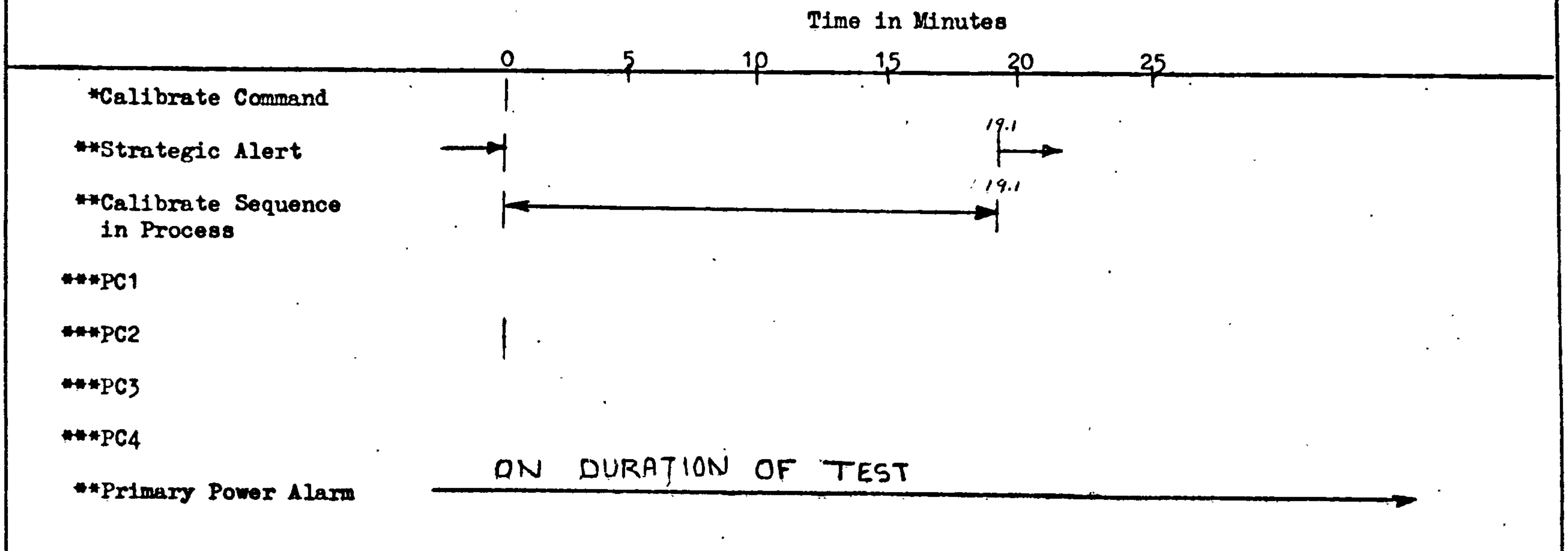
5.4 After Strategic Alert is regained, a Launch Sequence was initiated. Selected P/G interface signals were recorded. The Timer Speedup Inhibit switch was ON.

6. Test Summary

6.1 The oscillograph records show no signal on channel 13, which is Ignite First Stage Engine, Ignitor number one. The signal for the number two ignitor is present on channel 14. The absence of the signal on channel 13 was due apparently to an error in instrumentation. Several Launch sequences were performed later, monitoring the Ignite First Stage Engine switch with an oscilloscope. In all cases the signal was present.

6.2 Table 3.2.2.14-1 is a timing diagram showing the Calibrate and Launch Sequence recorded for this test.

TABLE 3.2.2.14 -1



CALIBRATE SEQUENCE - EMERGENCY POWER

*P/G Input

**P/G Output

***Coupler output to C-119A

TABLE 3.2.2.14 - 2

P/G Output	P/G Timing Pulses
Strategic Alert	→ 0
NCU & Elec. Pwr. ON	0 – 4; 6 – 11
Activate Missile Batt.	7 – 30
G&C System Pwr. OFF	11 – 12
Remove Closure	19.5 – 30
Arm All Ordnance Dev.	17 – 30
Critical Leads Disconnect	17 – 30
Release G&C Umbilical	17 – 30
Retract G&C Umbilical	17 – 30
Ignite 1st Stage Engine	26 – 30

L LAUNCH SEQUENCE-EMERGENCY POWER

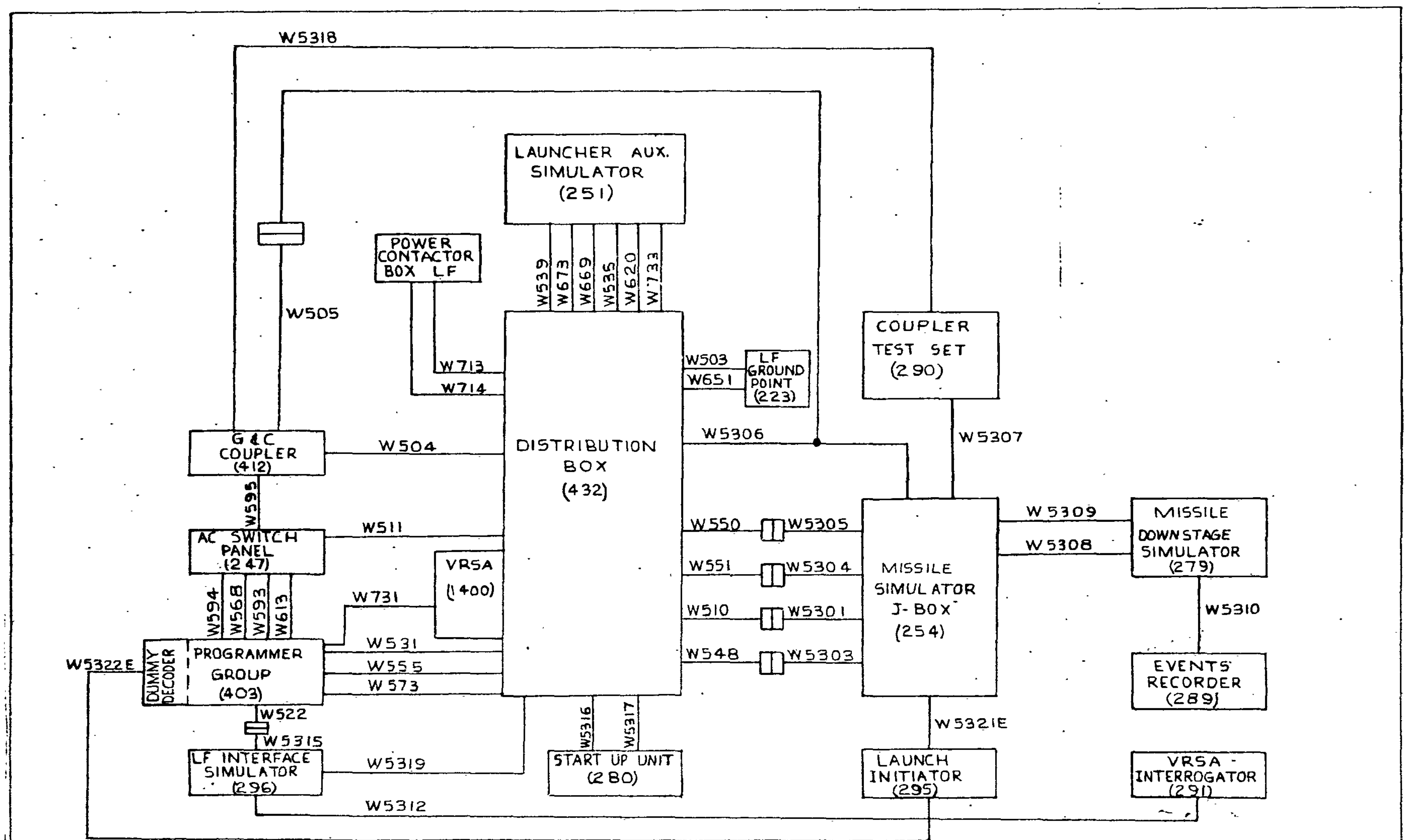


FIGURE 3.2.2.1-1 (LAB POWER)

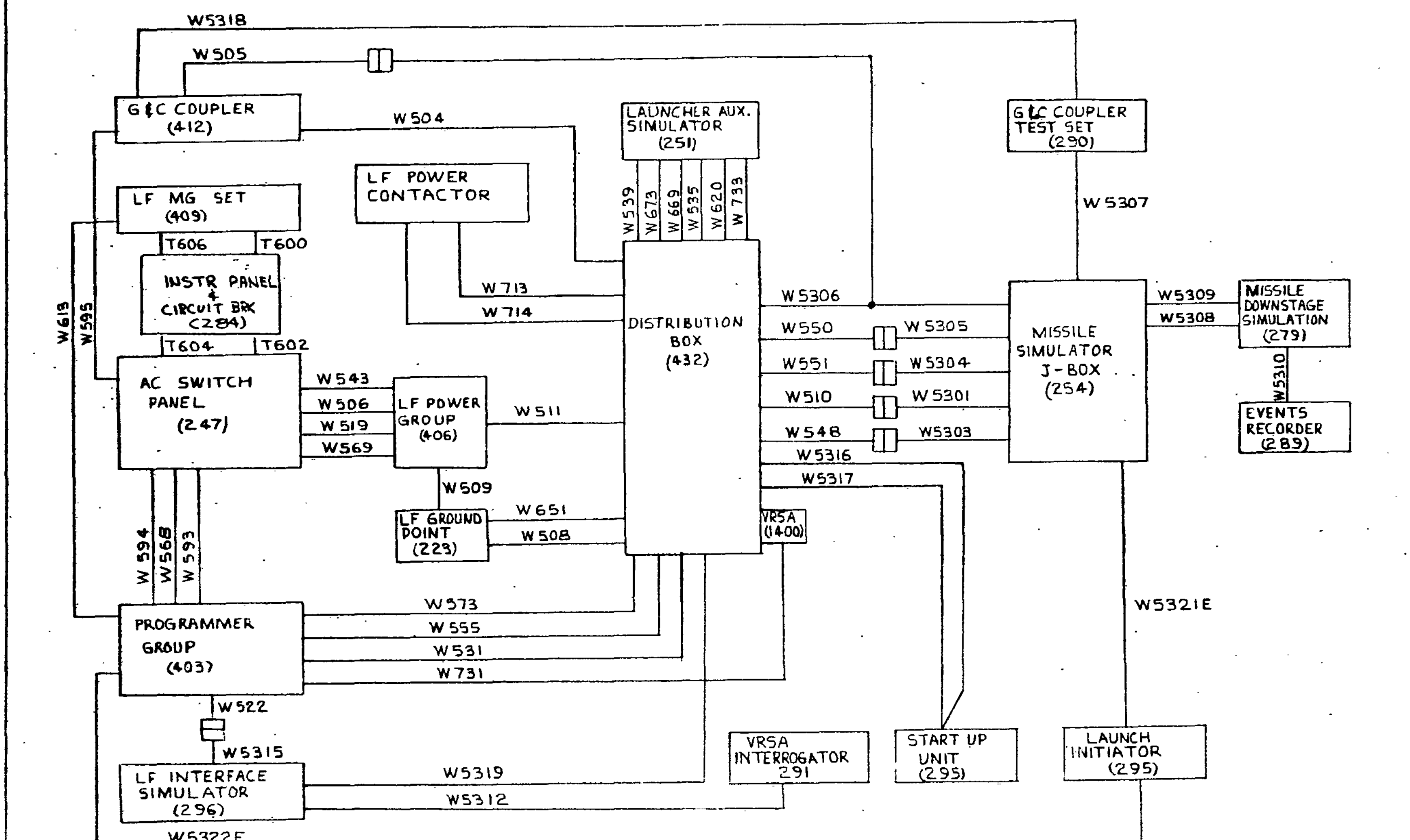


FIGURE 3.2.2.2-1 (H & D POWER)

REVISED B

BAC 4339

2-5000

THE BOEING COMPANY

NUMBER T2-2555, Vol. III

SECTION TITLE NRA III-1B Test Reports

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REV SYM B

2-5142-2

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TEST REPORT 3.1.1.1

1. TITLE

LCF Power Supply Group, Load Test and 400 Cycle Voltage Variation

2. OBJECTIVES

2.1 To determine the power requirements of the LCF Power Supply Group D. C. Supplies

2.2 To investigate the effects of low 400 cycle input voltage upon D. C. Voltage regulation.

3. CONCLUSIONS

3.1 The output voltage of the 48 amp and 12 amp supplies remains constant until 400 cycle input voltage reaches 90 volts (phase). The output voltage then drops off linearly at a rate of 1.8 VDC for every 5 volts decrease in input voltage.

3.2 The input current to the SCN racks decreases at a fairly constant rate until the D. C. Output of the Power Supplies reaches 18 volts (60 volts 400 ∿ input). The current drops off sharply after this point.

4. EQUIPMENT IN TEST

4.1 SAC/CTE, P/N 8319702-502, S/N 0000002

4.2 Power Supply Group, P/N 25-24197-40, S/N 0002

4.3 Command Message Processing Group, P/N 8323614-502, S/N 0000005

4.4 Digital Data Group, P/N 8323562-501, S/N 0000004

4.5 Status Message Processing Group, P/N 8323615-502, S/N 0000004

4. EQUIPMENT IN TEST (Cont'd)

4.6 Launch Control Console, P/N 25-24172-14, S/N 0003

4.7 Communications Control Console, P/N 25-27095-5, S/N 0000005

5. TEST DESCRIPTION

5.1 The equipment was connected per Figure 3.0.0.0-1 and 3.1.1.1-1

5.2 The LCF 400 cycle voltage was set to 120 VAC (Phase).

5.3 All breakers on the LCF Power Supply Group were closed, AC breaker first.

5.4 The SCN was turned ON and all alarms and status lamps extinguished on the LCC.

5.5 The speakers on the PAS Panel were turned ON.

5.6 A 1000 cps tone was applied to the SAC/CTE inputs via the loaded cable, Simulator Patch Panel (P/N 8323356). Outputs were terminated with 600 ohms.

(a) Eight 465 L Channels:

INPUT	OUTPUT
LAR1I	LAR10
LAR2I	LAR20
LAR3I	LAR30
LAR4I	LAR40
LAR5I	LAR50
LCR9I	LCR00
LCF0I	LCF90
LA--I	

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5.6 (Cont'd)

(b) PAS/SAC:

INPUT	OUTPUTS
PSM-I	PSM10
	PSM20
	PSM30

(c) PAS/NAFH

INPUT	OUTPUTS
PNM-I (Terminated with 600 Ω also)	PNM10
	PNM20
	PNM30

(d) EWO:

INPUT	OUTPUT
E-R-I	E-B-O
	E-R-O
	E-B-I

5.7 Each input signal was adjusted so that the output of each amplifier was +3dbm

5.8 The 400 cycle ØA voltage to the LCF Power Supply Group was photographed.

5.9 Photographs were made of ripple at each of the nine Power Supply Group outputs, and of one SAC/CTE Terminal Amplifier (after the repeat coil).

5.10 The 400 cps input voltage was lowered in 5 volt steps to 50 volts, recording the following at each setting.

(a) Input current for each phase.

(b) Input voltage phase A.

(c) Input power (using two wattmeter method)

(d) Current for each Power Group Output

(e) Voltage for each Power Group Output

(f) Figure A 1213A Power supply drawer output voltages:

(1) J2 - A & B	(5) J2 - D & G
(2) J2 - K & G	(6) J2 - C & G
(3) J2 - L & G	(7) J2 - J & G
(4) J2 - H & G	(8) J2 - E or F & G

5.11 The output of the EWO amplifier was photographed at the lowest voltage setting to record any distortion at the Sine Wave input.

6.0 TEST SUMMARY

6.1 Table 3.1.1.1-1 tabulates steady-state measurements made at the input to the LCF Power Group.

6.2 The D. C. voltage outputs of the LCF Power Group Supply fluctuated ±.05 volts below 95 volts input.

6.3 Power readings were made using the two wattmeter method. At the time the test was run, however, the proper size wattmeters co could not be obtained. Deflections were less than one quarter scale, so accuracy of the readings is questionable. The power

6.3 (cont'd)

readings presented in Table 3.1.1.1-1 should be taken as approximations only. This portion of the test will be rerun at a later date.

7. GENERAL INFORMATION

7.1 Test Engineer: Richard Mathias

7.2 Date test completed: 5/31/63

7.3 Applicable ER's:

(a) SAC/CTE, U039316, U178486, U094190, U094011, U094196, U186820, U094222

(b) Power Supply Group

E491048, E491045, U042692, U147275, U201036, E491119, U201036, U147261, U184420

(c) Command Message Processing Group

U043005, U042709, U187508, U093876, U093881, U093886, U187518, U187516, U187426, U093880, U093884

(d) Digital Data Group

U147251

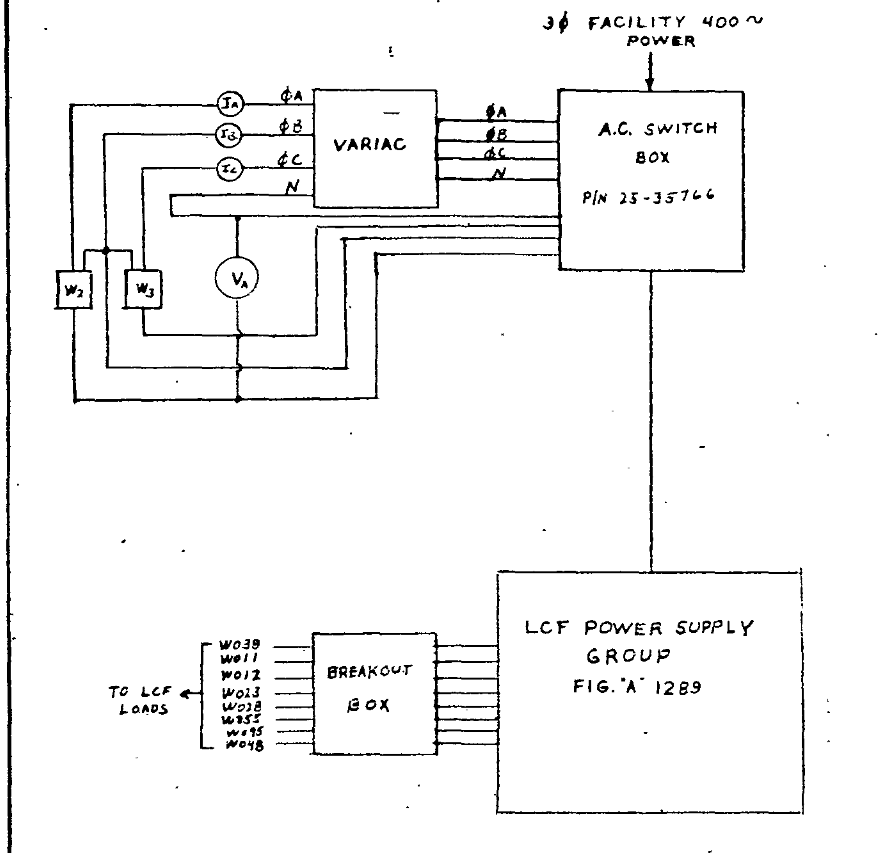
(e) Status Message Processing Group

U187507, U187428, U187430, U187437, U193878, U187427, U187429, U187431, U093877, U093887

	Input Phase Voltage (Vrms)														
	120	115	110	105	100	95	90	85	80	75	70	65	60	55	50
ØA (Amps)	4.1	3.8	4.1	4.1	3.8	3.9	3.9	3.7	3.4	3.3	3.3	2.9	2.7	1.4	1.3
ØB (Amps)	4.0	4.1	4.0	3.9	3.7	3.7	3.7	3.7	3.6	3.4	3.1	2.9	2.6	1.5	1.3
ØC (Amps)	4.3	4.3	4.3	4.3	4.0	4.0	3.9	3.9	3.9	3.7	3.4	3.2	2.9	1.7	1.5
Total Power (Watts) 1	1380	1390	1250	1230	1150	1085	990	950	870	760	640	558	485	240	220

1 See Paragraph 6.3 Test Summary

TABLE 3.1.1.1-1



INSTRUMENTATION FOR MEASUREMENT OF INPUT CURRENT & POWER

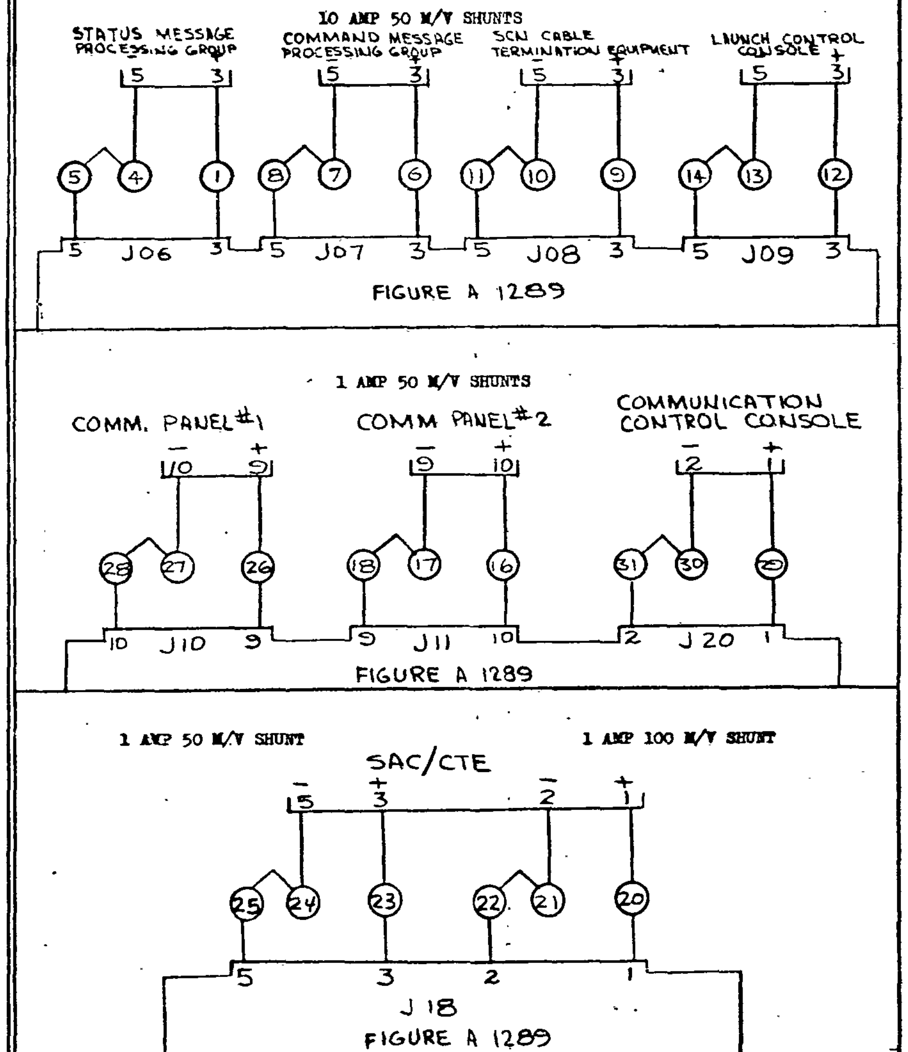


Figure 3.?.1.1-?

INSTRUMENTATION FOR MEASUREMENT OF OUTPUT CURRENTS

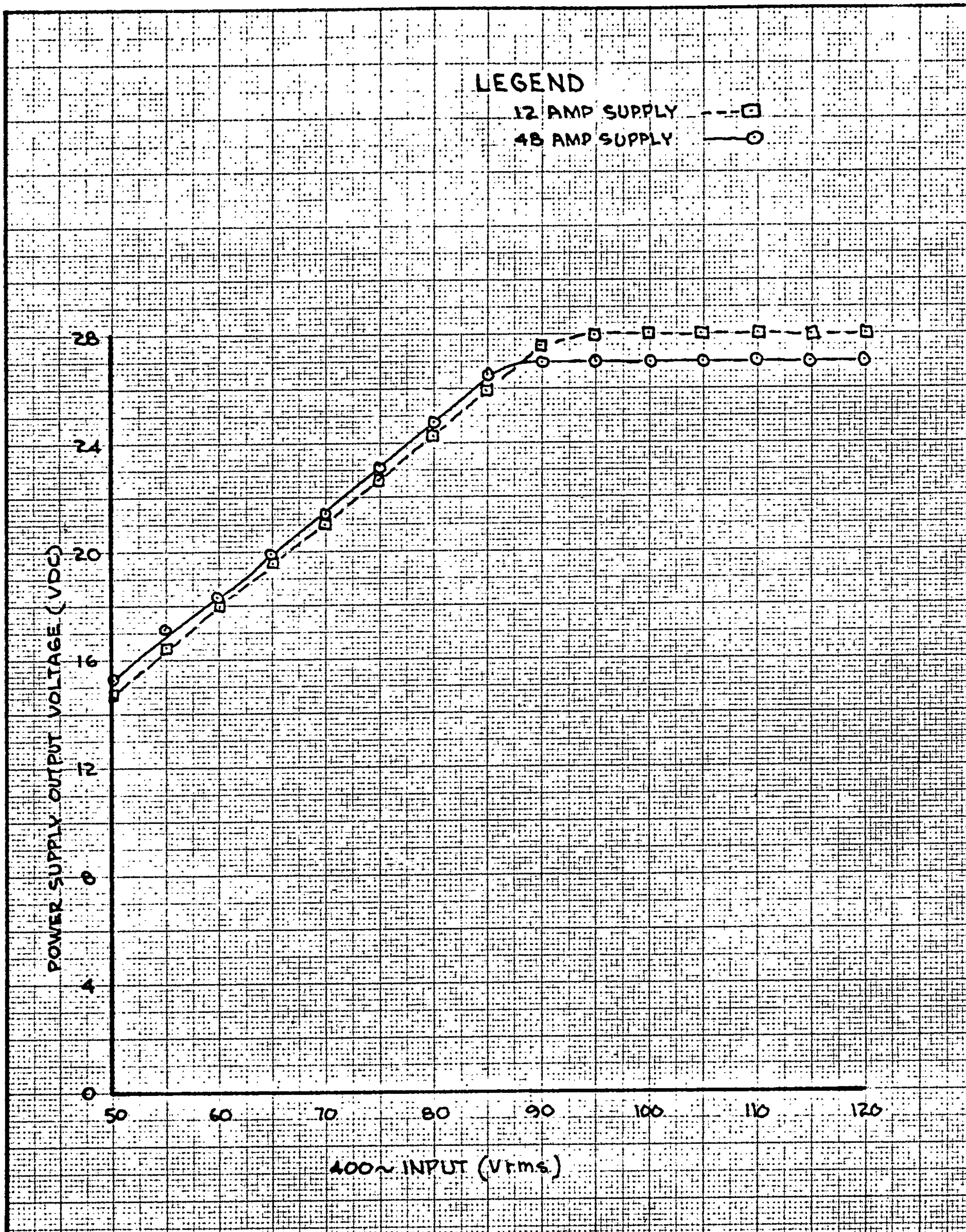


FIGURE 3.1.1.1-2

CALC			REVISED	DATE	LCF POWER SUPPLY GROUP INPUT VOLTAGES	T2-2555 Vol. III
CHECK						
APR						Sec. D
APR					THE BOEING COMPANY	PAGE 9

U3 4013 6000

REV B

K+E ALBANENE 196L TRACING PAPER 68587

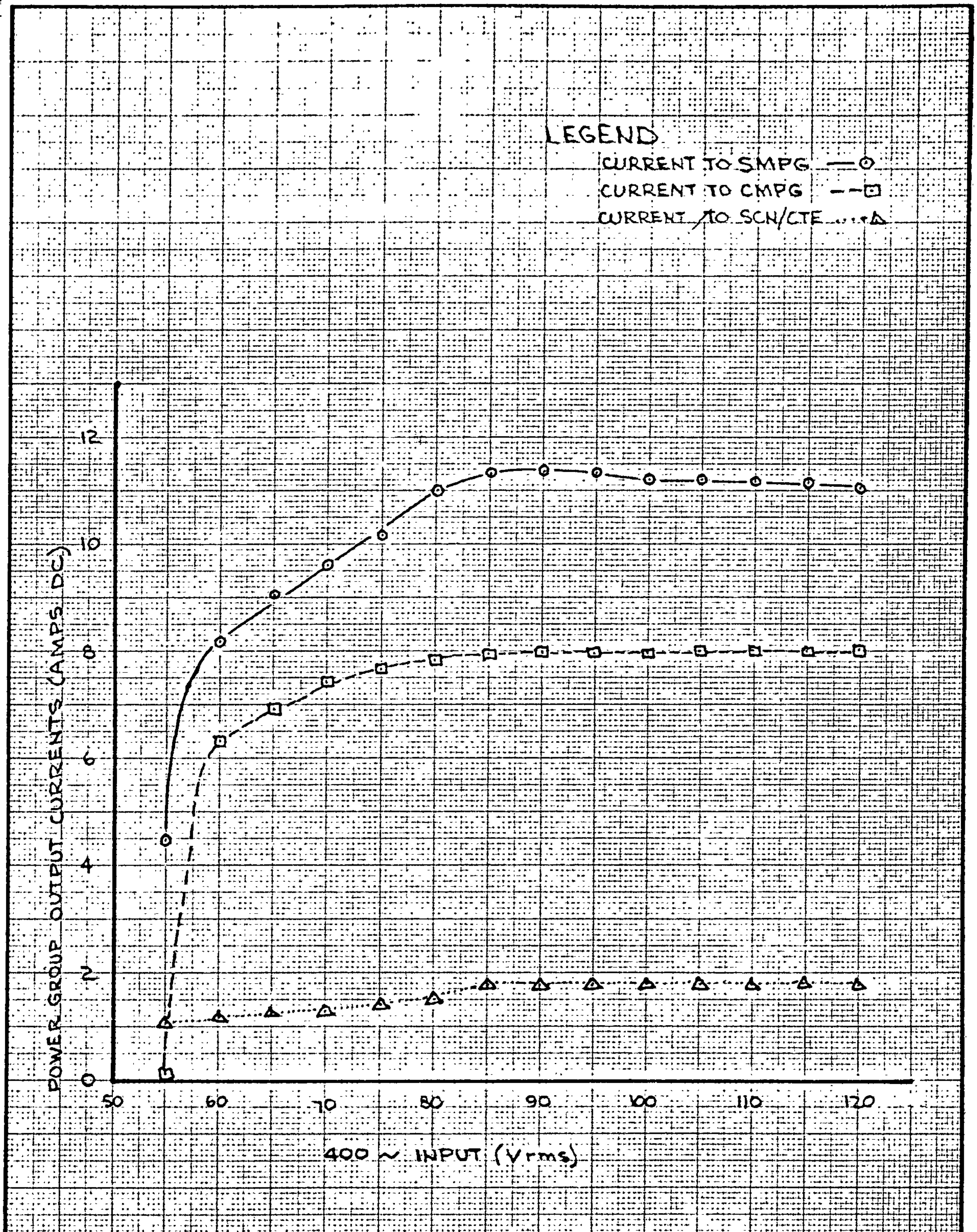


FIGURE 3.1.1.1-3

CALC			REVISED	DATE	LF/SCN INPUT CURRENTS	T2-2555 Vol. III Sec. D
CHECK						
APR						
APR					THE BOEING COMPANY	PAGE 10

US 4013 8000

REV B

K+E ALBANENE 196L TRACING PAPER 68387

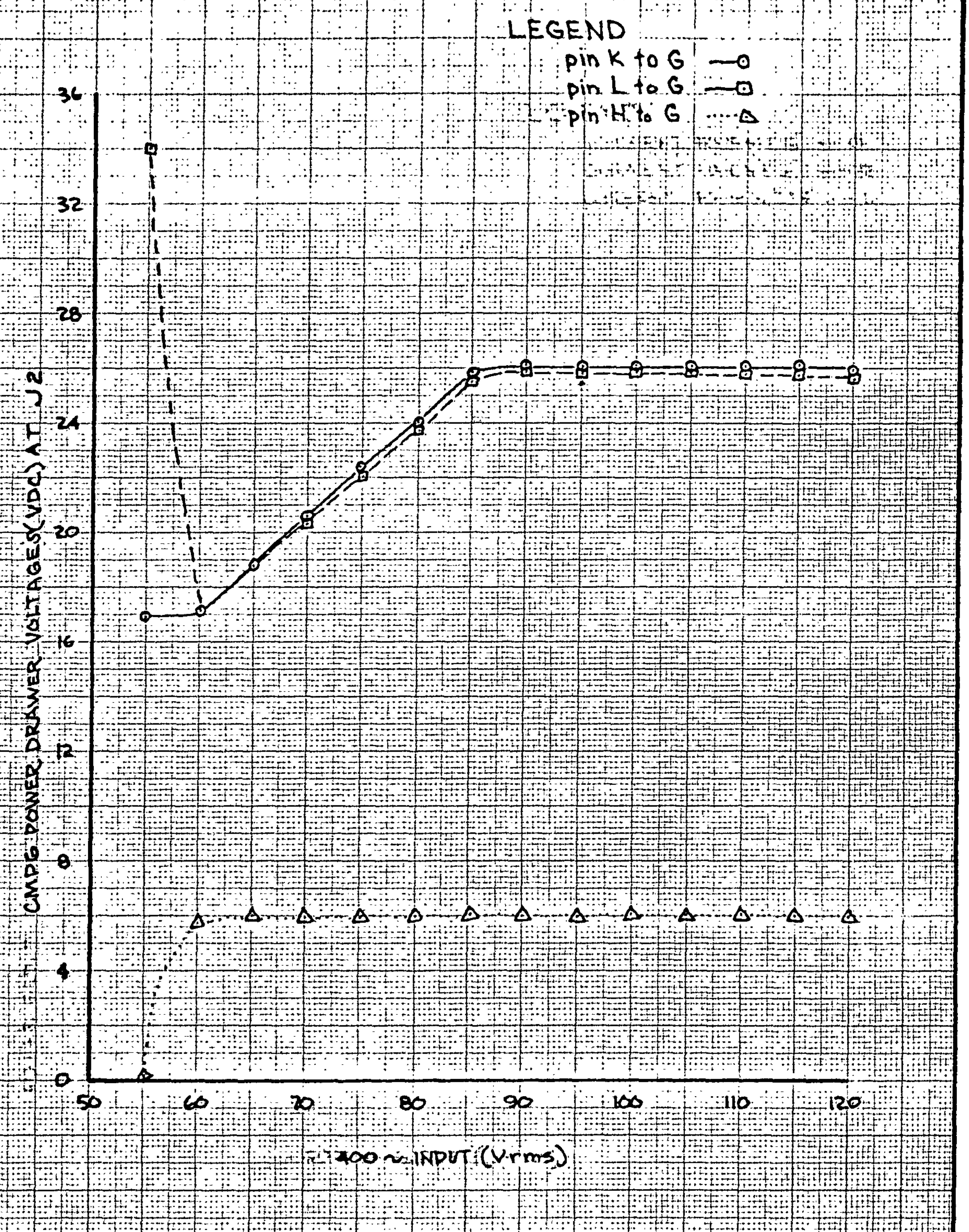


FIGURE 3.1.1.1-4

CALC			REVISED	DATE	+ DC VOLTAGE AT 304 RACK POWER SUPPLY	TZ-2555 Vol. III
CHECK						Sec. D
APR					THE BOEING COMPANY	PAGE 11
APR						

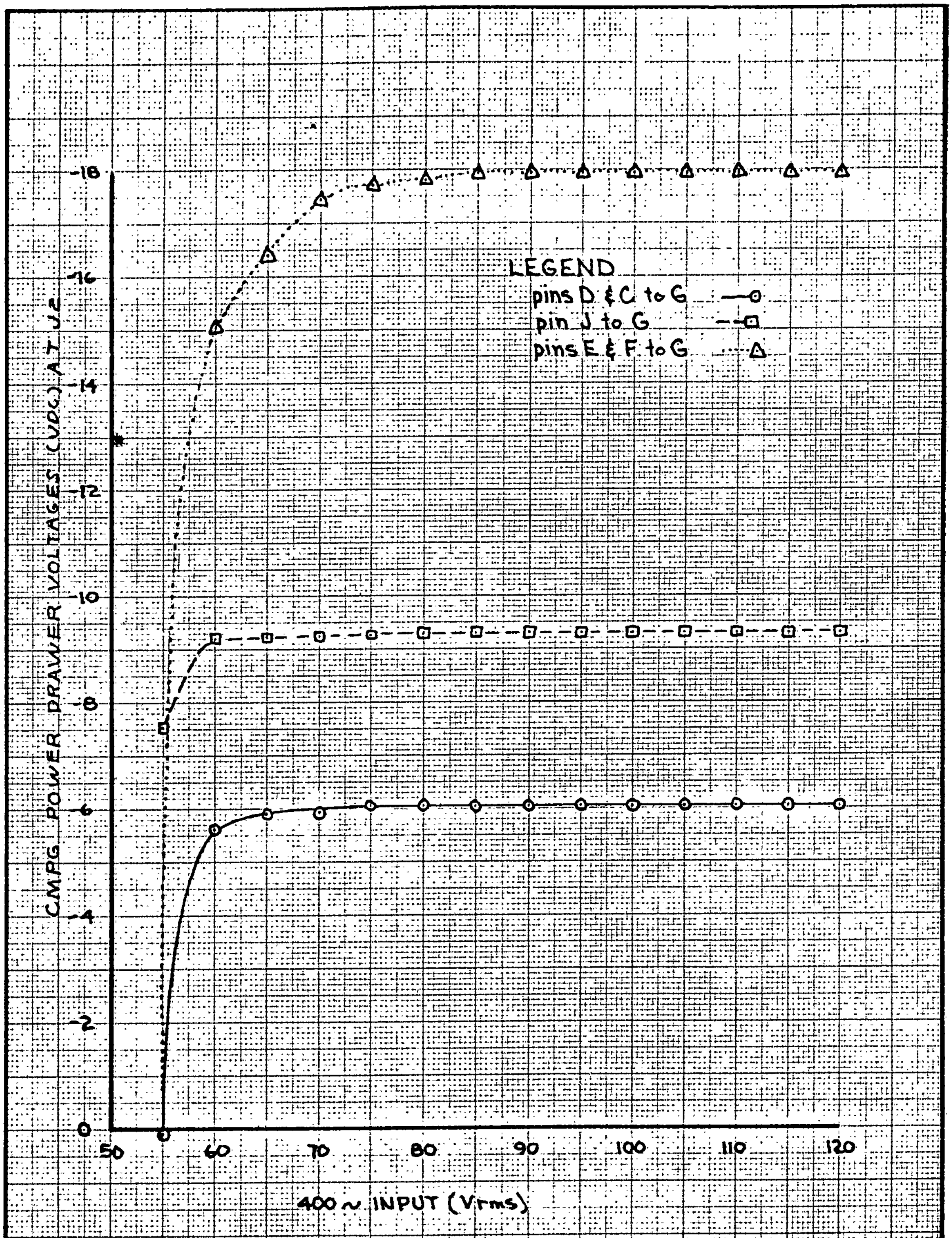


FIGURE 3.1.1.1-5

CALC			REVISED	DATE	-DC VOLTAGE AT 304 RACK POWER SUPPLY	T2-2555 Vol III Sec. D
CHECK						
APR						
APR					THE BOEING COMPANY	PAGE 12

US 4013 8000

REV B

K+E ALBANENE 196L TRACING PAPER 68587

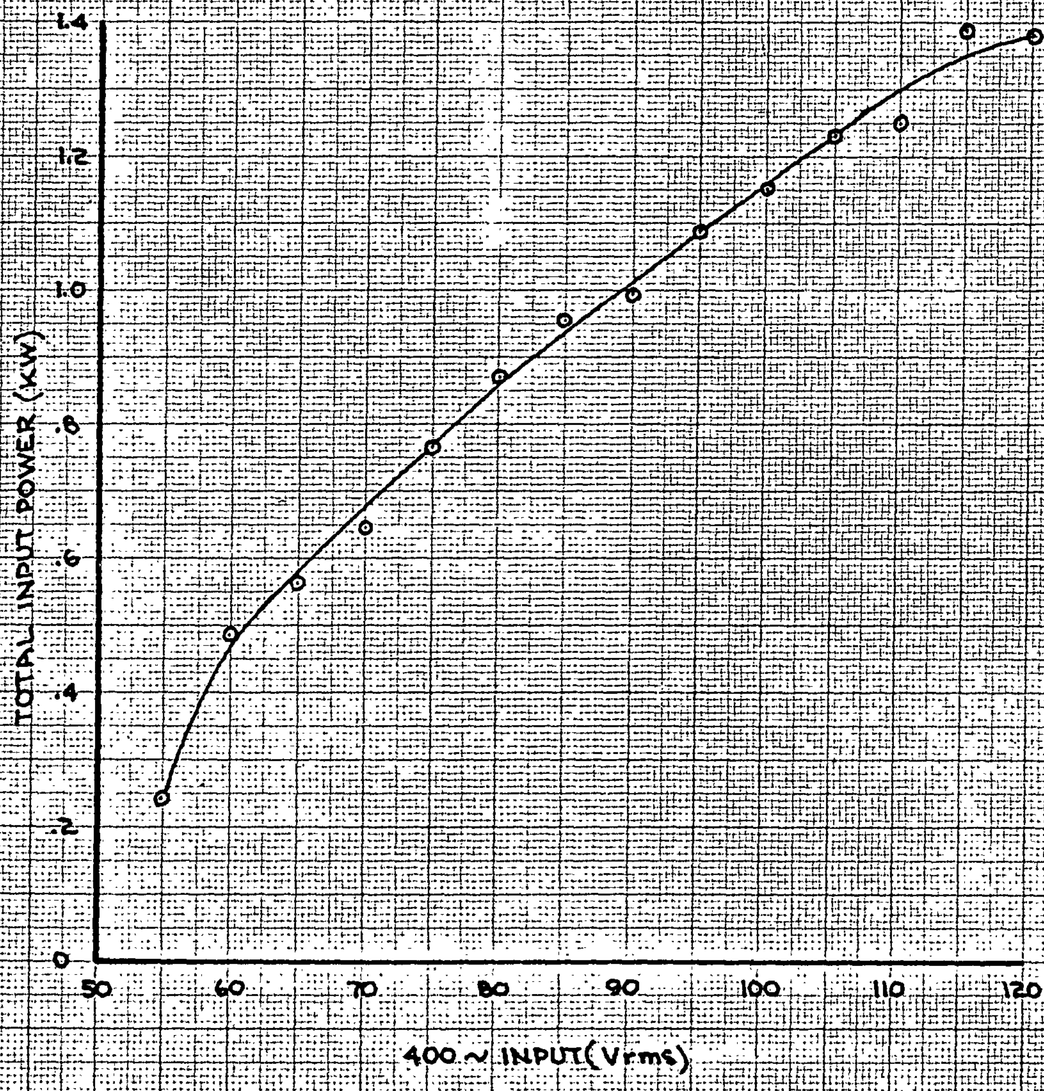
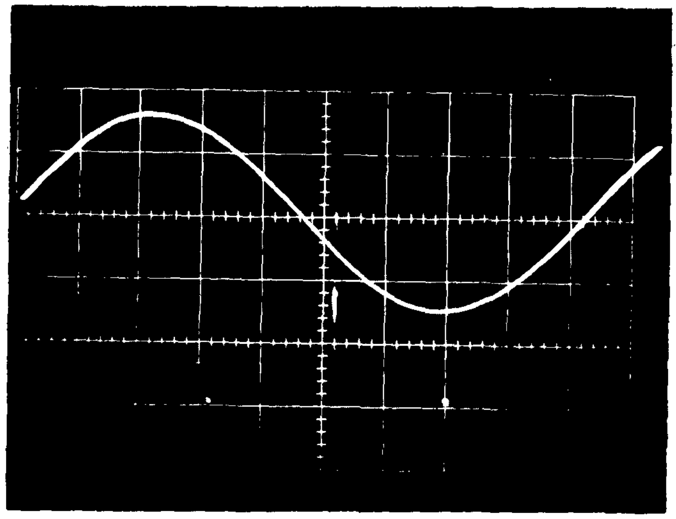


FIGURE 3.1.1.1-6

			REVISED	DATE		
CALC					LCF POWER GROUP INPUT POWER	T2-2555 Vol. III
CHECK						Sec. D
APR					THE BOEING COMPANY	PAGE 13
APR						

TEST 3.1.1.1



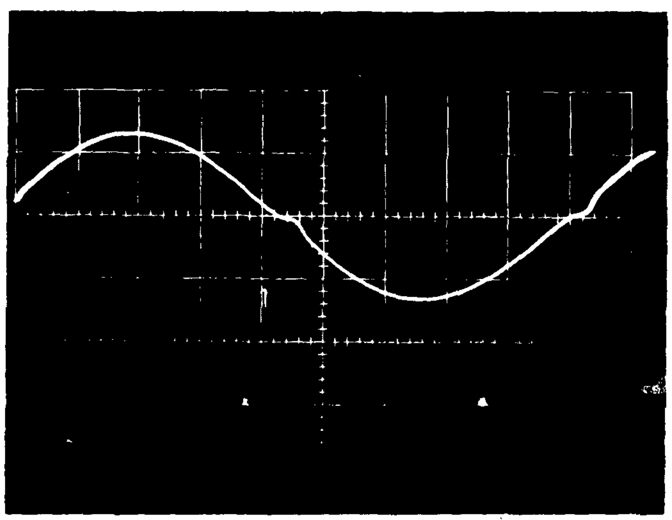
EWO Output Signal

Input 1000 cps Tone
from an Oscillator

2 Volt/cm

.1 ms/cm

Photo #1 400~ Voltage @ 120V



EWO Output Signal

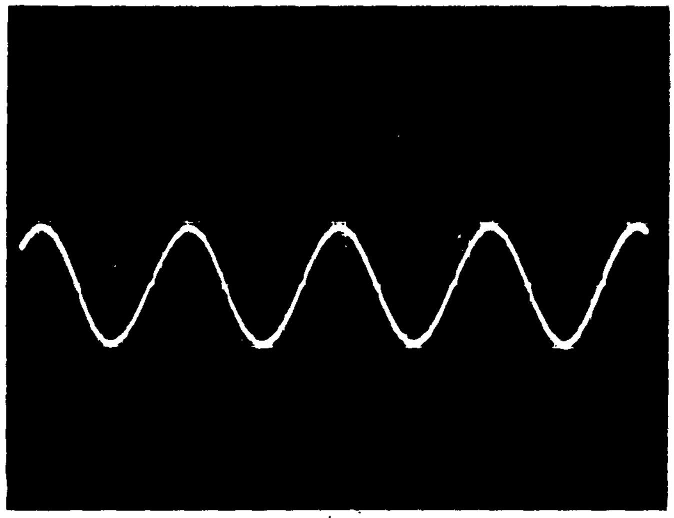
Input 1000 cps tone
from an Oscillator

2 Volt/cm

.1 ms/cm

Photo #2 400~ Voltage @ 50V

TEST 3.1.1.1

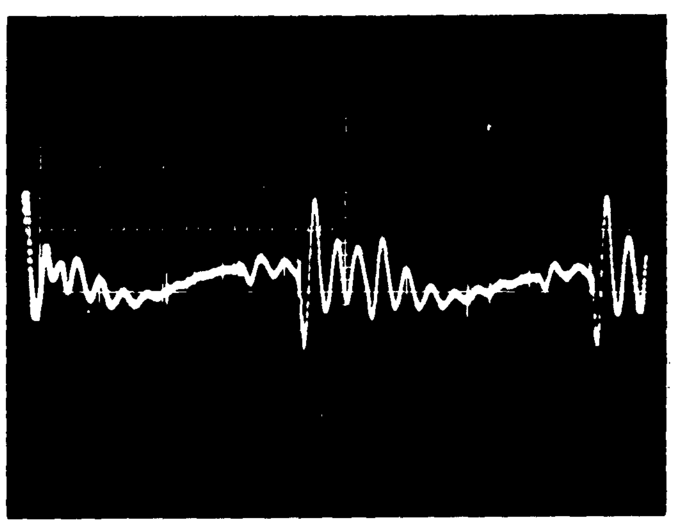


LCF Power Group
(Fig A 1289) Input
Phase A, Facility
LAB Power

200 Volt/cm

1 ms/cm

Photo #3

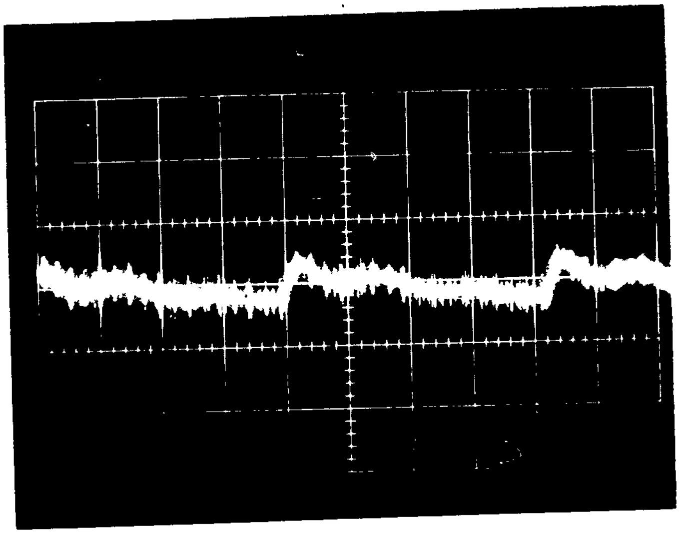


Ripple of Fig A
1265 Supply @
Fig. A 1289
.1 Volt/cm

.1 ms/cm

Photo #4

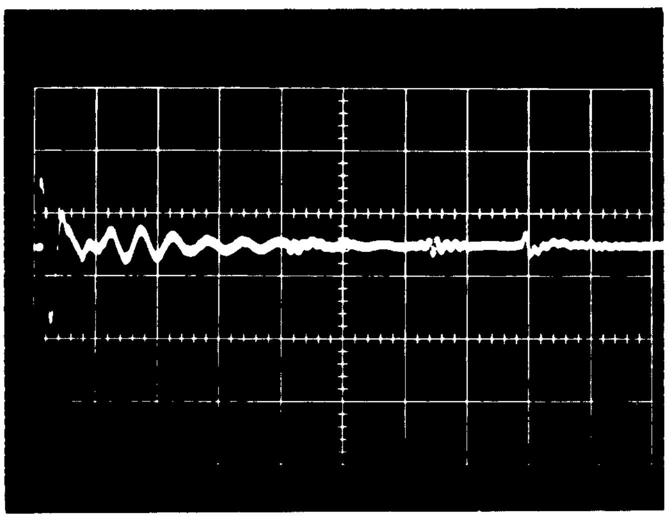
TEST 3.1.1.1



Voltage Ripple of
Communication Control
Console Supply @
Fig. A 1289
.05 volt/cm

2 ms/cm

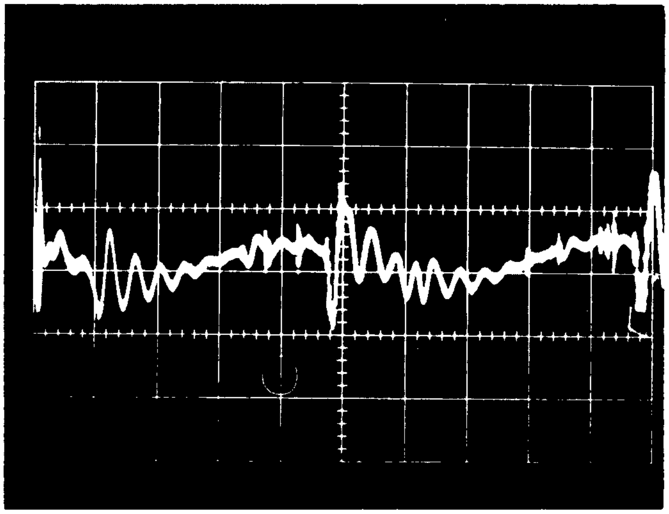
Photo #5



Voltage Ripple of
Communication Panel
of Communication
Control Console @
Fig. A 1289
.2 Volt/cm

.5 us/cm

Photo #6

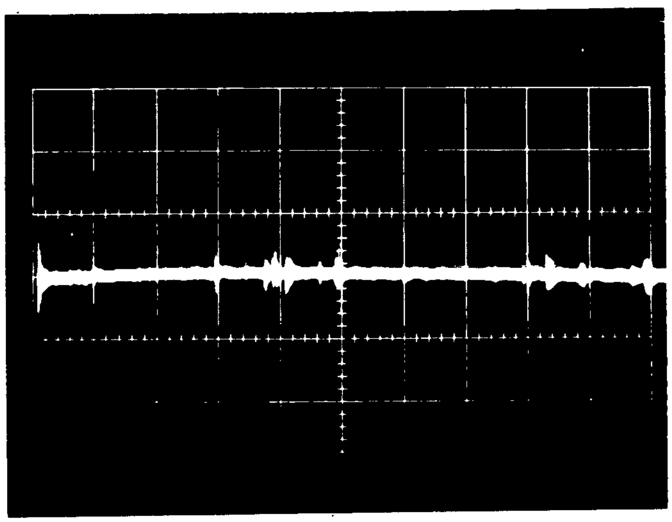


Voltage Ripple of
Launch Control Console
Supply @ Fig. A 1289

.05 volt/cm

.1 ms/cm

Photo #7



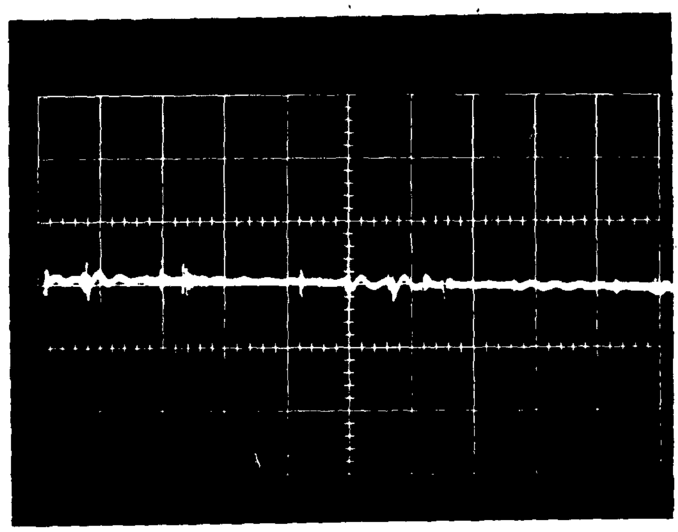
Voltage Ripple of
Communication Panel
of Launch Control Console
@ Fig. A 1289

.05 volt/cm

.1 ms/cm

Photo #8

TEST 3.2.1.1

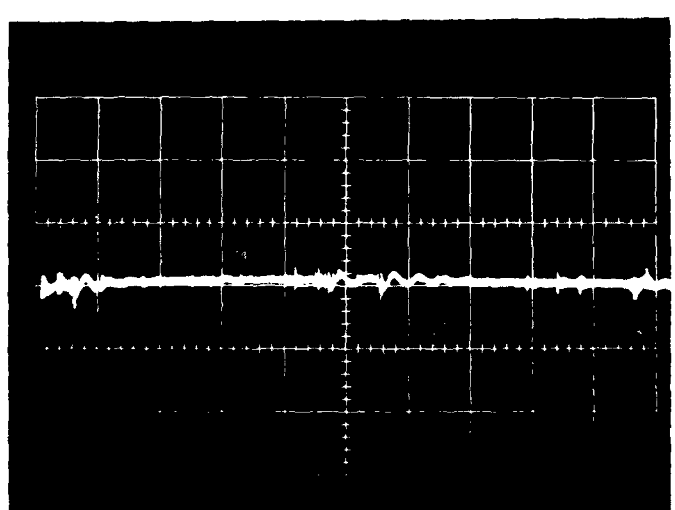


Voltage Ripple of SAC/CTE Supply. @ Fig. A 1289

.05 Volt/cm

.1 ms/cm

Photo #9



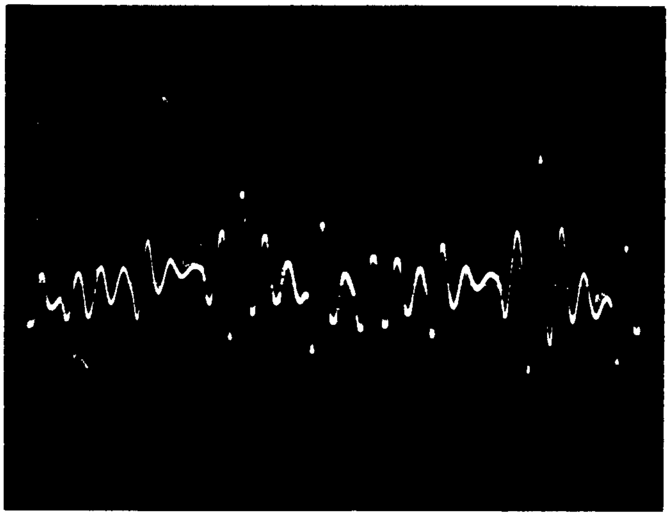
Voltage Ripple of
PAD Panel at Input to SAC/CTE
SAC/CTE rack @ Fig. A 1289

.05 Volt/cm

.1 ms/cm

Photo #10

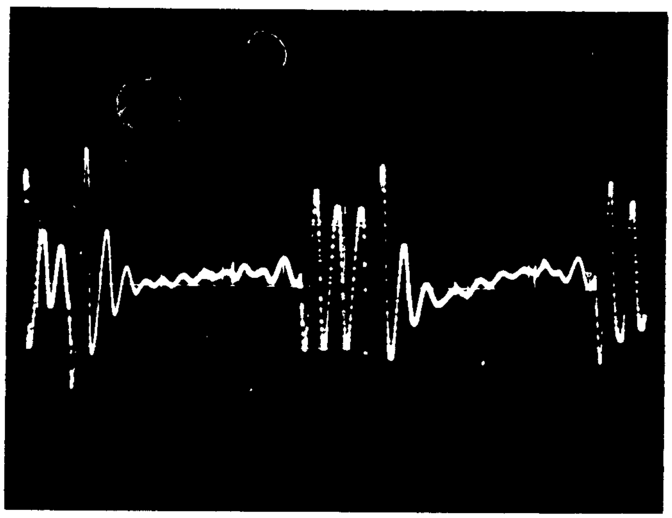
TEST 3.1.1.1



Ripple of Fig A 1213B Supply @ Fig. A 1289
.1 Volt/cm

.1 ms/cm

Photo #11



Ripple of Fig A 1213A Supply @ Fig. A 1289
.1 Volt/cm

.1 ms/cm

Photo #12

U3 4288 2000 REV. 8/62 2-5142-2

TEST REPORT 3.1.1.2

1. TITLE

Launch Control Console Load Test

2. OBJECTIVES

To determine the DC power requirements of the Launch Control Console (LCC) under various conditions of status display.

3. CONCLUSIONS

3.1 The LCC turn-on transients are shown in photograph #1 through #4. Although quite large, the current surges apparently have no detrimental effects on the LCF Power Group.

3.2 Current surges on turn on were approximately 40 amps larger when the LCC was turned on before the Status Message Processing Group. Under this condition all lamps in the status panel are illuminated and maximum steady-state current is drawn.

3.3 The voltage output of the LCF Power Group 48 amp supply drops at the instant the current transient is at its maximum. The voltage is shown as the lower trace on photographs #3 and #4.

3.4 Ripple at the input to the LCC does not increase appreciably when the SCN is turned on. Ripple is shown in photographs #7 and #8.

3.5 The steady state current readings were somewhat larger than the values given in D2-4853-2, "Launch Control System Electrical Load Analysis, Operational Launch Control Facility". A comparison of the test results with D2-4853-2 is given in the Test Summary of this report (See Table 3.1.1.2-1).

4. EQUIPMENT IN TEST

4.1 Launch Control Console, P/N 25-24172-14, S/N 0003

4.2 LCF Power Group, P/N 25-24197-40, S/N 0002

5. TEST DESCRIPTION

5.1 The equipment was connected per Figures 3.1.1.2-1 and 3.0.0.0-1. The LCF Power Group was operating on 400 cycle facility power.

5.2 The current shunt was installed in the positive side of the input (J1-3) to the LCC.

5.3 The SCN racks were turned on.

5.4 With the SCN racks on, the LCC circuit breaker on the LCF Power Group was opened and closed. Photographs were taken of turn on transients and ripple. With the breaker closed, steady state measurements of current and voltage were made.

5.5 The SCN was turned off and the measurements and photographs of 5.4 repeated.

5.6 The Status Message Processing Group was turned back on and steady state current measurements were taken.

5.7 The status lamp panels were reset a pair at a time, and current measurements made after each panel was reset.

6. TEST SUMMARY

6.1 Current transient measurements were made using a standard shunt inserted in the positive input to the LCC, and a Tektronix type D Differential Preamp. The oscilloscope was referenced to structure ground to reduce noise pickup. A type CA preamp was used to measure the voltage transients. Potential difference between structure ground and power return was 0.51 volts.

6.2 The maximum current condition occured when the SCN was turned OFF and then ON, with the LCC remaining On. All status lamps were ON under this condition.

6.3 The minimum current condition was with all status lamps OFF. In this test, the Missile Away indicator on each status panel remained ON. This condition was used as the "average" value listed in Table 3.1.1.2-1.

6.4 Current required to light the lamps in one status panel (20 lamps) was 1.3 amperes. Current required for the Alarm panel lamp test was 0.8 amps.

7. GENERAL INFORMATION

7.1 Test Engineer: Norman Noe, Dept. 2-6519-14

7.2 Date Test completed: 5/31/63

7.3 Applicable E R's:

U 147543	U201036	E491119
U 147553	E491048	E491045

Data Source	Steady State Voltage	Start up Time to SS Limit (ms)	Voltage Transients		Ripple Limits		Current Inrush 1	INPUT				Duty Cycle
								Peak		Average		
			Excour-sion % Nominal	Recovery Time (ms)	P-P Volts	Freq.		Amps	Watts	Amps	Watts	
D2-4853-2	28 Volts	25 ms	±5%	25 ms	0.3 volt	2.4 kc		9.0	266	5.2	145	Cont.
Test 3.1.1.2	27.8 Volts	10 ms	-50%	10 ms	0.14	2.4 kc	2 120 Amps	11.0	295	3.5	93.8	Cont.

1 Listed as Inrush KVA in D2-4853-2

2 Approximately 160 Amps if LCC Turned On before SMPG

TABLE 3.1.1.2-1

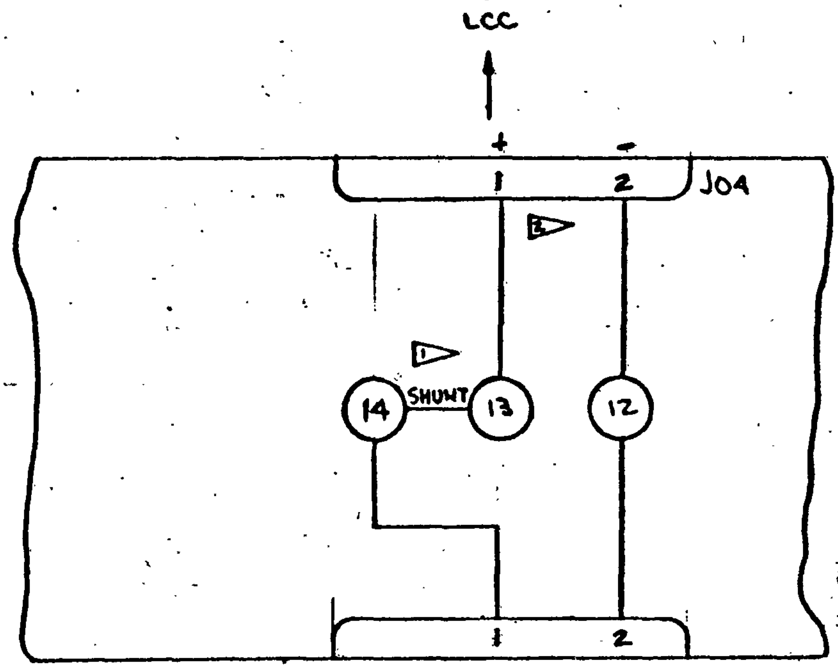


FIG A 1289 BREAKOUT BOX

1 USE 5 OR 10 AMP SHUNTS AS REQUIRED

2 VOLTAGE MONITOR POINT

FIGURE 3.1.1.2-1

REV SYM B

TEST 3.1.1.2

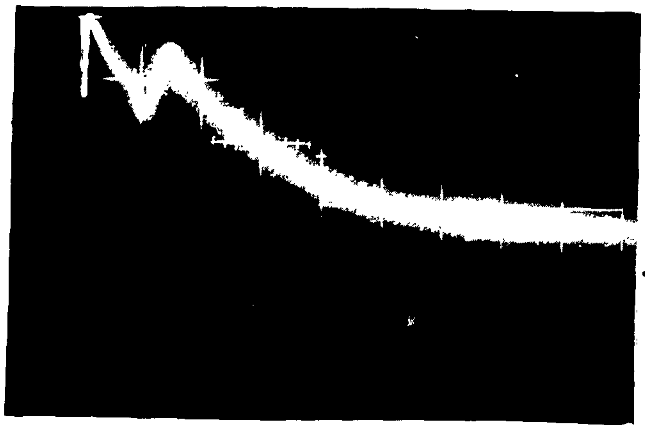


Photo #1 LCC turn-on, current transient. LCF/[illegible] racks OFF.
Trace is voltage drop across a 10 amp, 50 mv. shunt.
2ms/cm, 200 mv/cm Type D preamp. Scope grounded to
300mcm ground bus.

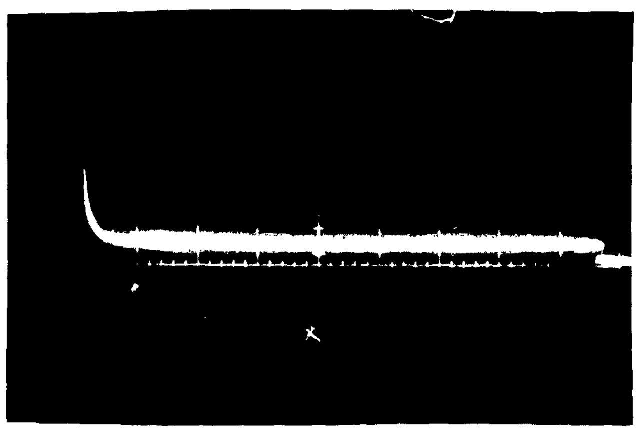
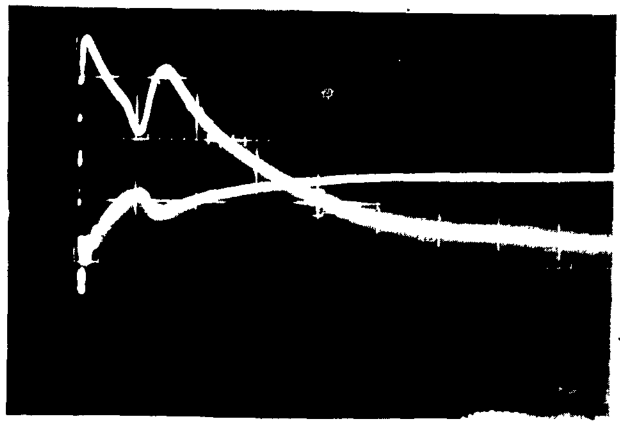


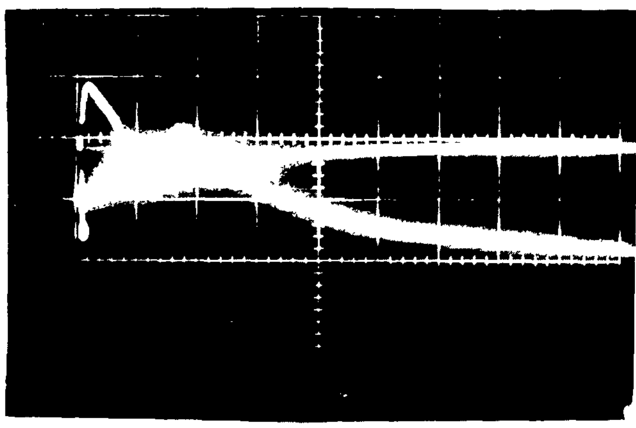
Photo #2 LCC turn-on and turn-off, current transient. LCF/[illegible]
racks OFF. Trace is voltage drop across a 10 amp,
50 mv shunt. 200mv/cm, 50ms/cm Type D preamp.
Scope grounded to 300mcm ground bus.

T[illegible]T [illegible].1.1.[illegible]



← O Ref.

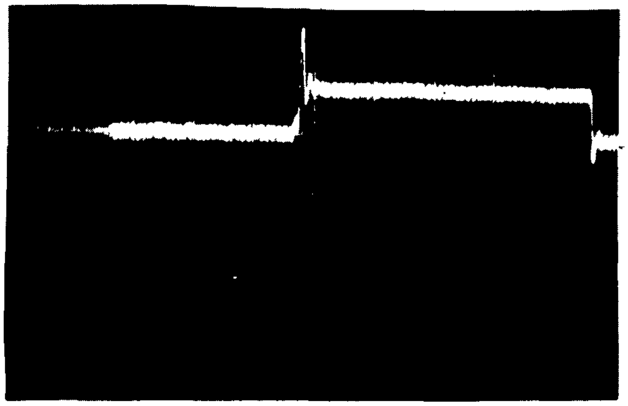
Photo #3 Top trace: Turn-on current transient. [illegible]00mv/cm
Lower trace: Turn-on voltage transient. 10v/cm
Both sweeps 2ms/cm, triggered by current transient.
Top trace is voltage drop across a 10 amp,
50 mv shunt. All [illegible] SCR racks were OFF. Type D
preamp was used. Scope was grounded to 300mcm
bus. Voltage trace is positive side of input.



← O Ref.

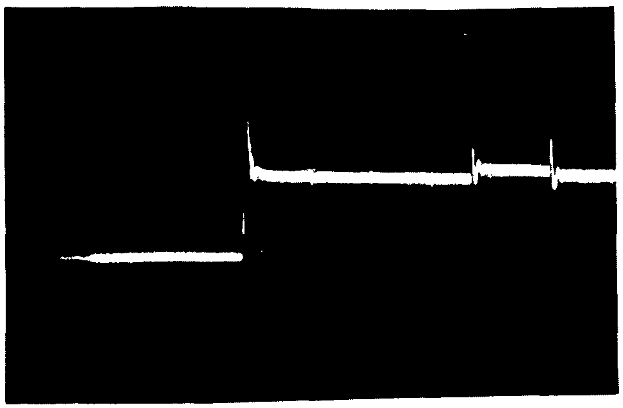
Photo #4 Top trace: Turn-on current transient. 200 mv/cm
Lower Trace: Turn-on voltage transient. 10 mv/cm
Both sweeps 2 ms/cm, triggered by current transient.
Top trace is voltage drop across a 10 amp, 50 mv
shunt. Voltage trace is positive side of input,
referenced to structure ground. SCR racks were ON.

TEST 3.1.1.2



10 mv/cm
200 ms/cm
DC Coupling

Photo #5 Current Transient, Lamp Test Performed on one Status Panel.
18 lamps on and then off
Trace is voltage drop across a 10 amp, 50 mv shunt in Positive Input.



20 mv/cm
200 ms/cm
DC Coupling

Photo #6 Current Transient, SMPG turned off then on
Trace is voltage drop across 10 amp, 50mv shunt in Positive Input to LCC.

TEST 5.1.1.5

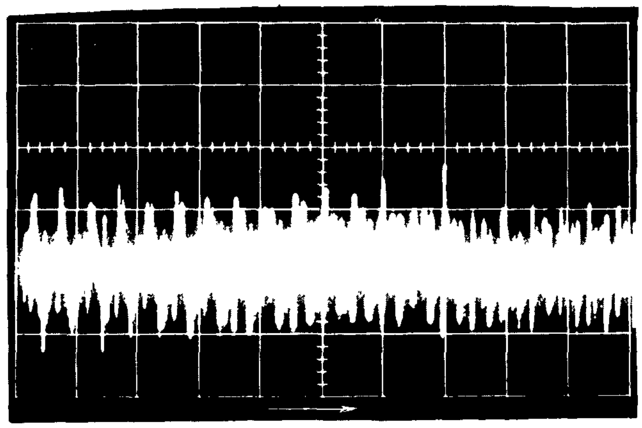


Photo 7 Noise and Ripple at +28 Volt Input
Monitor Point J1-3 referenced to J1-5
SCN Racks ON 0.05 v/cm 1.0 ms/cm

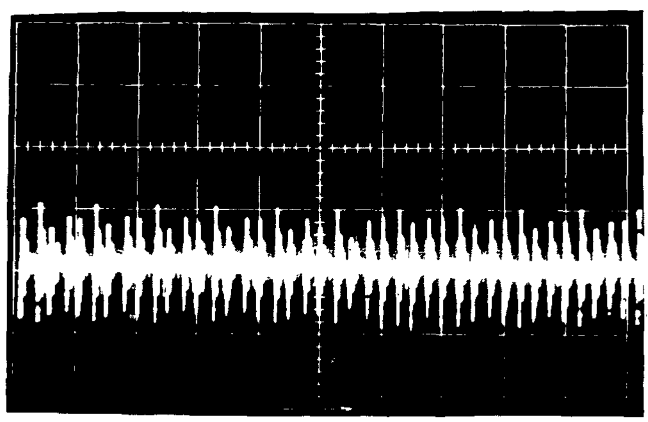


Photo 8 Noise and Ripple at +28 Volt Input
Monitor Point J1-3 reference to J1-5
SCN Racks OFF 0.05 v/cm 1.0 ms/cm

TEST REPORT 3.1.1.3

1. TITLE

LCF Load Test, Communications Control Panel

2. OBJECTIVES

To determine the D.C. power requirements of the Communications Control Panel, for comparison with D2-4853-2.

3. CONCLUSIONS

3.1 The turn-on transients of the communications panel were considerably smaller than listed in D2-4853-2. Peak current at turn-on was 4 amperes (see photographs 1 and 2). No significant drop in voltage at turn on could be observed. Current stabilization time was approximately 5 ms.

3.2 Ripple at the input to the communications panel was lower than listed in D2-4853-2. The noise & ripple measurements were made with the SCN racks operating (see Table 3.1.1.3-2).

3.3 When the LCC was being rung on the HVC lines, some sharp transients were observed on the trailing edge of the 1 pps signal from the button light flasher unit (See photographs 3 and 4). The magnitude of these current spikes varied from 0.38 to 0.43 amp.

3.4 Average values of current were lower than listed in D2-4853-2 (see table 3.1.1.3-1)

4. EQUIPMENT IN TEST

4.1 Telephone Transmitter control P/N 1274013-503, S/N 0000003.

4.2 LCF Power Group P/N 25-22552-36, S/N 0002.

5. TEST DESCRIPTION

5.1 The equipment was connected per figure 3.0.0.0-1 and 3.1.1.3-1.

5. TEST DESCRIPTION (Con't)

5.2 All buttons were released and the volume control turned to minimum.

5.3 The LF/SCN and Telephone Connecting and Switching Set were turned on.

5.4 The breaker for the LCC communications panel was opened and closed while photographs of current transients were taken.

5.5 Buttons on the communications panel were depressed in different sequences and current and voltage measured for such condition.

5.6 A ringing tone (1250 cps) was applied to the HVC Receive input (C2VR) at the patch panel. The 1 pps flasher current was photographed.

6. <u>TEST SUMMARY</u>

6.1 Table 3.1.1.3-1 is a tabulation of steady state measurements made in this test.

6.2 Current measurements were made using a Differential Voltmeter and a 1 amp 100 mv shunt. Current transients were photographed using a 10 amp, 50 mv shunt and a Tektronix differential preamp.

6.3 The maximum current condition was with the following buttons depressed:

1. All speaker buttons
2. OPR, LF #2
3. EWO #1
4. LCC

The Telephone Connecting and Switching Set was turned ON for this section of the test.

7. GENERAL INFORMATION

7.1 Test Engineer: Norman Noe

7.2 Date completed: 4/22/63

7.3 Applicable E R's: None

Control Button Positions	Voltage (volts)	Current (amps)	Power (watts)	Ripple (mv p-p)
All Buttons Out, Volume Control Minimum	27.99	0.071	1.99	32
LF #2 and OPR Depressed	28.00	0.071	1.99	32
LCC Button Depressed	28.01	0.168	4.71	32
SCC Button Depressed	27.98	0.074	2.07	32
UHF Button Depressed	27.98	0.168	4.71	32
VHF Button Depressed	27.98	0.071	1.98	32
HF Button Depressed	27.98	0.168	4.71	32
VHF Speaker Button Depressed	27.99	0.11	3.08	32
TEL. Speaker Button Depressed	27.99	0.11	3.08	32
UHF Speaker Button Depressed	27.99	0.11	3.08	32
HF Speaker Button Depressed	27.99	0.11	3.08	32
All Speaker Buttons Depressed	27.99	0.23	6.44	32
All Speaker Buttons, OPR, LF#2, EWO #1 and LCC Buttons Depressed	28.03	0.33	9.25	32

TABLE 3.1.1.3-1

DATA SOURCE	VOLTAGE	VOLTAGE TRANSIENTS		RIPPLE LIMITS		INRUSH KVA	INPUT				DUTY CYCLE
							PEAK		AVERAGE		
		EXCUR-SION %	RECOV-ERY TI-ME (SEC)	P-P VOLTS	FREQ.		AMPS	WATTS	AMPS	WATTS	
D2-4853-2	28 VDC	±43	0.025	0.3	2400	0.03	1.1	31	1.1	31	Cont.
3.1.1.3	28 VDC	No Transients observed		.03	2400	1	0.33	9.24	2 .168	4.7	Cont.

1 Current transient was 4 amps (see photograph #1)

2 Condition with LCC Button depressed used as "Average"

TABLE 3.1.1.3-2

COMM PANEL #1

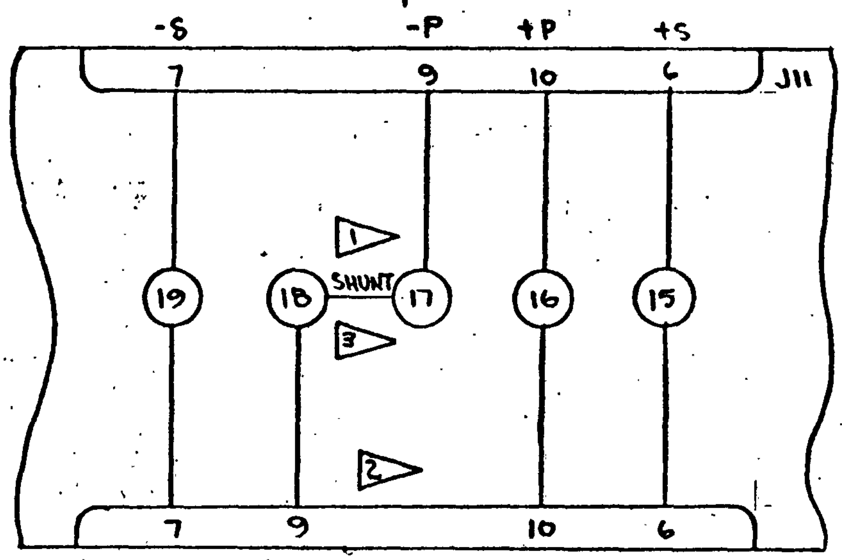


FIG "A" 1289 BREAKOUT BOX

1 USE 1.0 AMP 50 MV SHUNT FOR CURRENT MEASUREMENT USING DIFF. VOLTMETER.

2 MONITOR VOLTAGE AT PINS 9 & 10

3 USE 10 AMP 100 MV SHUNT FOR INPUT TO OSCILLOSCOPE

FIGURE 3.1.1.3-1

U3-4071-1000

REV SYM B

TEST [illegible].1.1.[illegible]

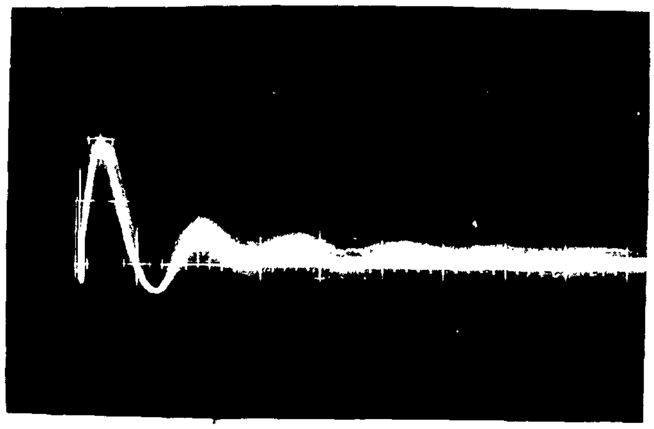


Photo #1 COMMUNICATIONS CONTROL PANEL CURRENT [illegible]
Trace is voltage drop across a 50mv, 10amp shunt inserted in positive input (J4-1[illegible]). All buttons OUT on panel. 1[illegible] mv/cm, 2 ms/cm. Referenced to structure ground.

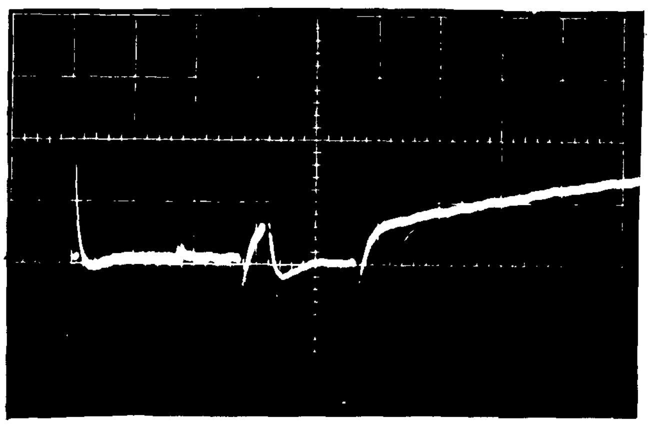
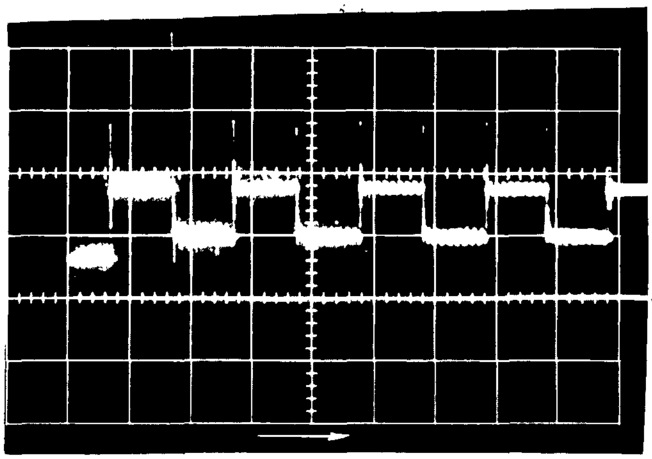


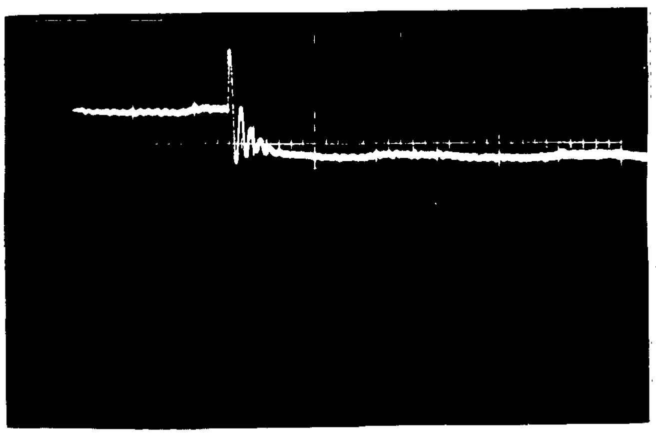
Photo #2 COMMUNICATIONS CONTROL PANEL CURRENT TRANSIENT,
Expanded scale. 50 µs/cm, 10 mv/cm across 10 amp 50 mv shunt.

[illegible] .1.1.



← 0 Ref.

Photo #3 [illegible] TO [illegible] L, [illegible] BUTTON [illegible]
[illegible]. 100 mv shunt in positive Input, J4-16. All [illegible] button [illegible], volume control at maximum setting.
10 mv/cm, 0.5 sec/cm. Referenced to structure ground.



← 0 Ref.

Photo #4 [illegible]
Spike on trailing edges of pulses in above picture.
Same information, except settings. 2 ms/cm, 10 mv/cm

TEST 3.1.1.3

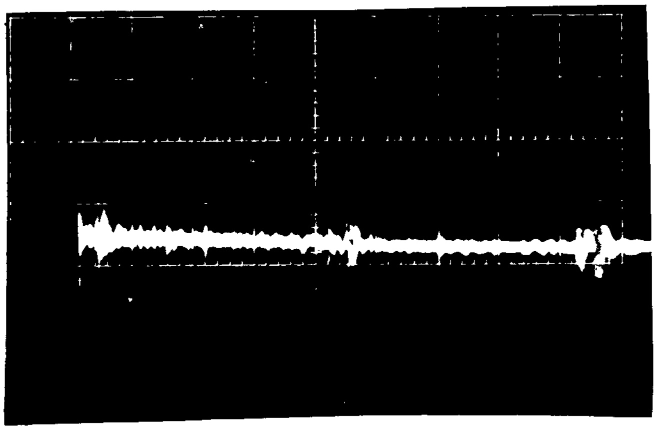


Photo #5 RIPPLE ON D.C. INPUT VOLTAGE TO CONT. PANEL. GSE racks on, LCC on. J4-[illegible] to 10. All buttons OUT 0.0[illegible] v/cm, 0.1 ms/cm

TEST REPORT 3.1.1.4

1. Title

   LCF Load Test, SCN Equipment

2. Objective

   To determine the power requirements of the LCF/SCN Equipment for comparison with D2-4853.

3. Conclusions

   3.1 Some data in D2-4853 is unrealistic when compared to actual data.

   3.2 Figure A 1213B ripple at drawer A7 is 1.5 volts peak-to-peak. Figure A 1213B ripple at Figure A 1289 Power Supply Group is 300 millivolts peak-to-peak

   3.3 Figure A 1213A and Figure A 1213B both have a current turn on transient of 120 amperes.

   3.4 The output of Figure A 1289, Power Supply Group, has a decrease in voltage of 6 volts, lasting 4.5 milliseconds when Figure A 1213B is switched on.

   3.5 Table 3.1.1.4-1 compares data of D2-4853 with data taken during this test.

4. Equipment in Test

   4.1 303 Rack, Figure A 1265, Digital Data Group P/N 8323562-501 S/N 0000004

   4.2 304 Rack, Figure A 1213A, Command Message Processing Group P/N 8323614-502 S/N 0000005

   4.3 305 Rack, Figure A 1213B, Status Message Processing Group P/N 8323615-502 S/N 0000004

4.4 301 Rack, Figure A 1289, Power Supply Group P/N 25-24197-40 S/N 0002

5. Test Description

5.1 The equipment was set up as shown in Figures 3.0.0.0-1 and 3.1.1.4-1

5.2 A dual sweep scope using two differential preamps was used to obtain the photographs. DC Inputs were used in most instances, except where noted.

5.3 All marks tone was applied to the LCF from the Message Simulator for nine channels. The one remaining channel received its input from the LF. Status from the LF was fed to one status channel of the LCF. The remaining nine status channels received status from the Message Simulator.

5.5 Steady state voltage, current, and ripple measurements were obtained.

5.6 On-off transients for Figure A 1265 were obtained by activating the CTE Circuit Breaker on the Figure A 1289 Power Supply Group.

6. Summary of Test Results

6.1 Throughout this test, the following abbreviations were used:

V = Voltage for Figure A 1265 measured at Figure A 1289

I = Current for Figure A 1265 measured at Figure A 1289

E1 = Voltage for Figure A 1213B measured at Figure A 1289

E2 = Voltage for Figure A 1213A measured at Figure A 1289

E3 = Voltage for Figure A 1213B measured at Pins A and B of test connector of drawer A7

E4 = Voltage for Figure A 1213A measured at Pins A and B of test connector of drawer A7

I1 = Current for Figure A 1213A

I2 = Current for Figure A 1213B

6.2 Figure A 1265 power consumption at idle is:

V = +26.447 Volts

I = 1.1 Amps

P = 29 Watt

6.3 Figure A 1213A power consumption at idle with the Launch Control Console on is:

E2 = 26.493 Volts

I2 = 8.0 Amps

P = 212 Watts

6.4 Figure A 1213B power consumption with Launch Control Console on and at idle condition is:

E1 = 27.468 Volts

I1 = 13.3 Amps

P = 332 Watts

6.5 Photographs of ripple, turn-on, and turn-off transients are attached.

6.6 Tabulation of test results are as shown on Tables 3.1.1.4-1 and 3.1.1.4-2

7. <u>General Information</u>

7.1 Test Engineer: Richard W. Mathias, 2-6519-14

7.2 Test Completed: 12 June 1963

7. General Information (cont'd)

7.3 Applicable ER's: Figure A 1213A, U201486, U043005, U042709, U187518, U187426, U093876, U093880, U093881, U093884, U093886, Figure A 1213B, U187507, U187427, U187428, U187429, U187430, U187431, U187437, U093877, U093878, U093887

Figure A 1265, no open ER'S

FIGURE "A"	START-UP TIME TO STEADY STATE SECONDS		TRANSIENTS EXCURSION (% NOM)		TRANSIENTS RECOVERY TIME (SEC)		RIPPLE LIMITS (Peak-to-Peak)		INRUSH KVA		AMPS		WATTS	
	D2-4853	Actual	D2-4853	Actual	D2-4853	Actual	D2-4853	Actual	D2-4853	Actual	D2-4853	Actual	D2-4853	Actual
1265	.025	.0025	43%	100%	.025		.3V	.12V	.45	2.5	.82	1.1	23	29
1213A	.025	.003	43%	7%	.025		.3V	.2V	2.4	3.25	8.15	8.0	228	212
1213B	.025	.005	43%	22%	.025		.3V	.35V	2.0	3.25	11.4	13.3	320	332

TABLE 3.1.1.4-1

CONDITION	E1	E2	E3	E4	I1	I2
Fig. A 1265 ON, Fig. A 1213A OFF, Fig. A 1213B OFF, LCC OFF	26.447	26.434	0	0	0	0
Fig. A 1265 ON, Fig. A 1213A ON, Fig. A 1213B OFF, LCC ON	26.174	26.493	0	25.552	0	8
Fig. A 1265 ON, Fig. A 1213A ON, Fig. A 1213B ON, LCC ON	27.204	27.110	25.808	26.541	13.3	8
Fig. A 1265 ON, Fig. A 1213A OFF, Fig. A 1213B ON, LCC ON	27.468	27.078	25.845	0	12.6	0

TABLE 3.1.1.4-2

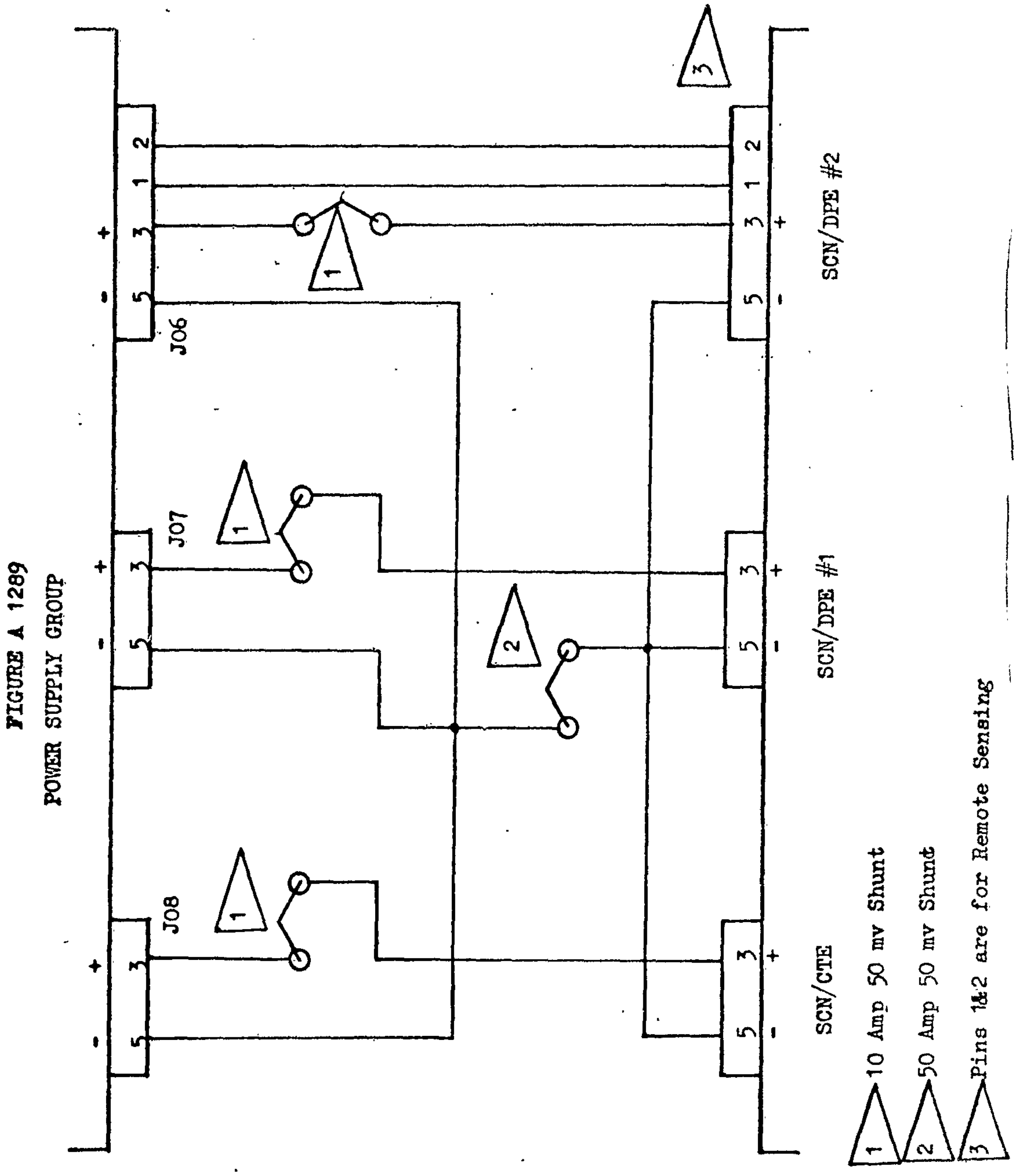
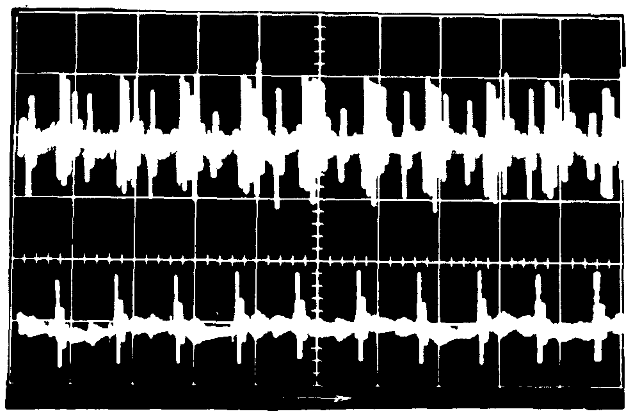


FIGURE 3.1.1.4-1

TEST 3.1.1.4



Top: Voltage (AC Input)

100 mv/cm

.5 ms/cm

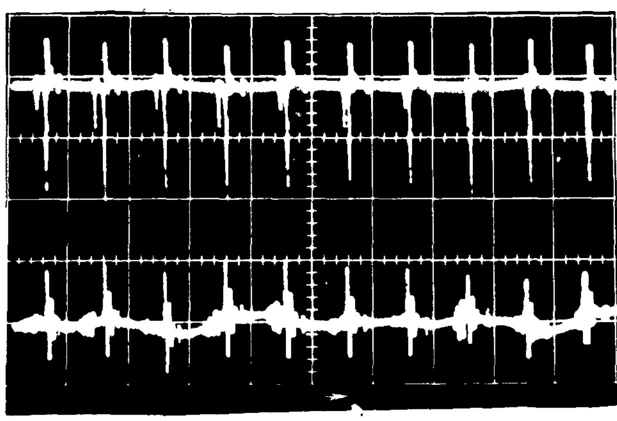
Bottom: Current (AC Input)

1 Amp/cm

.5 ms/cm

Photo #1 Fig A 1213A Ripple at Power Supply Group, Fig A 1289
Fig A 1213B ON
Fig A 1265 ON
Launch Control Console ON

Note: monitor points on Figure A 1289 Breakout Box (see Figure 3.1.1.4-1)



Top: Voltage (AC Input)

1 volt/cm

.5 ms/cm

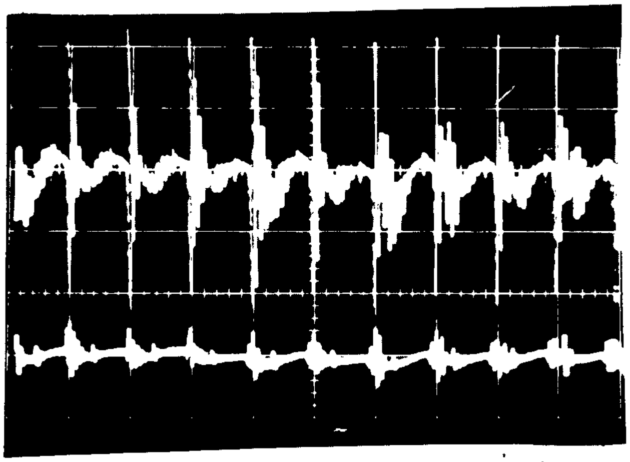
Bottom: Current (AC Input)

1 Amp/cm

.5 ms/cm

Photo #2 Fig A 1213A Ripple at Test Points A & B of J2, Drawer A7 of Fig A 1213A
Fig A 1213B ON
Fig A 1265 ON
Launch Control Console ON

TEST 3.1.1.4



Top: Voltage (AC Input)

100 mv/cm

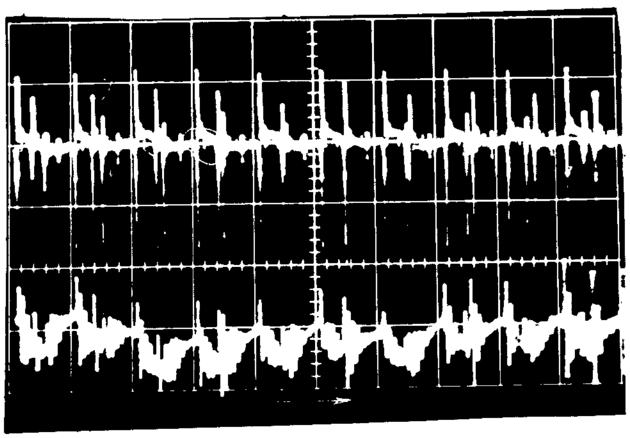
.5 ms/cm

Bottom: Current (AC Input)

1 Amp/cm

15 ms/cm

Photo #3 Fig A 1213B Ripple at Power Supply Group, Fig A 1289
Fig A 1213A ON
Fig A 1265 ON
Launch Control Console ON



Top: Voltage (AC Input)

500 mv/cm

.5 ms/cm

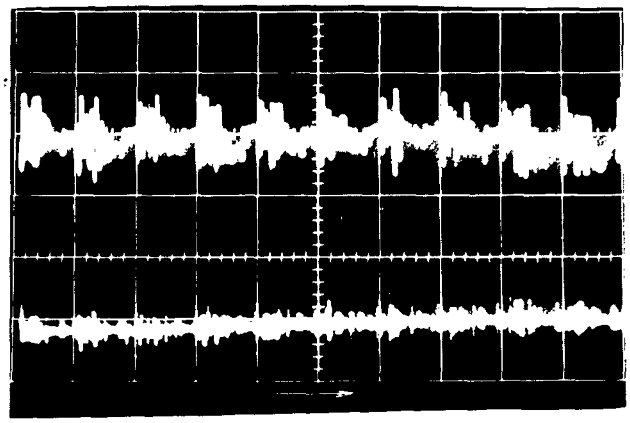
Bottom: Current (AC Input)

.4 Amp/cm

.5 ms/cm

Photo #4 Fig A 1213B Ripple at Test Points A & B of J2 Drawer A7 of Fig A 1213B
Fig A 1213A ON
Fig A 1265 ON
Launch Control Console ON

TEST 3.1.1.4



Top: Voltage (AC Input)

100 mv/cm

.5 ms/cm

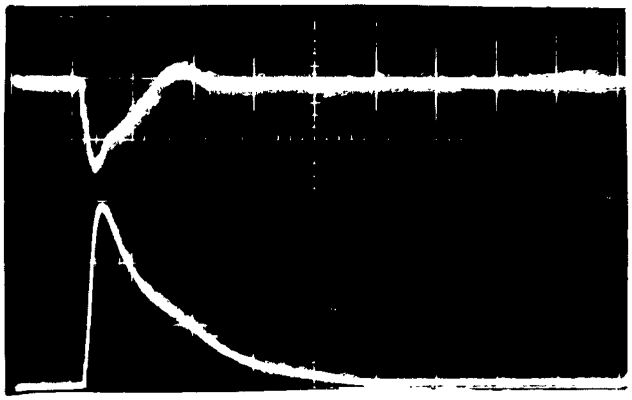
Bottom: Current (AC Input)

.2 Amp/cm

.5 ms/cm

Photo #5 Fig 1265 Ripple at Power Supply Group, Fig A 1289
Fig A 1213A ON
Fig A 1213B ON
Launch Control Console ON

TEST 3.1.1.4



Top: Voltage

1 Volt/cm

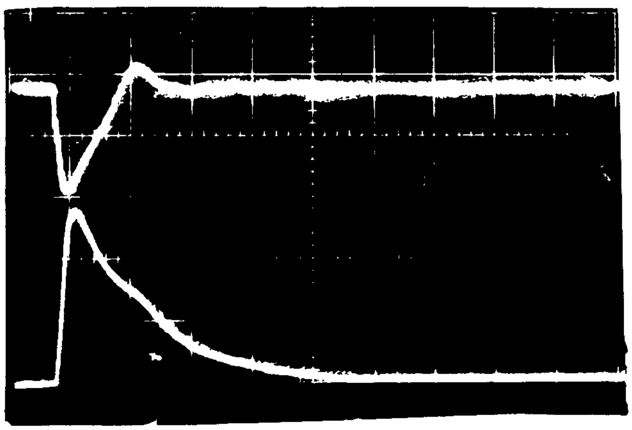
1 ms/cm

Bottom: Current

40 Amp/cm

1 ms/cm

Photo #6 Fig A 1213 A Turn-on at Power Supply Group, Fig A 1289
Fig A 1213 B ON
Fig A 1265 ON
Launch Control Console ON



Top: Voltage

1 Volt/cm

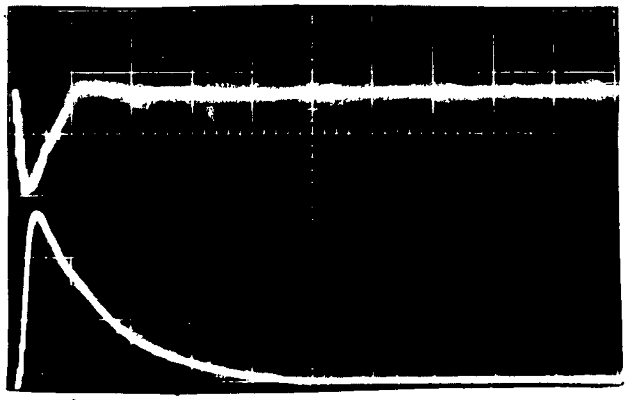
1 ms/cm

Bottom: Current

40 Amp/cm

1 ms/cm

Photo #7 Fig. A 1213A Turn ON at Power Supply Group, Fig A 1289
Fig A 1213B ON
Fig A 1265 ON
Launch Control Console OFF



Top: Voltage

1 Volt/cm

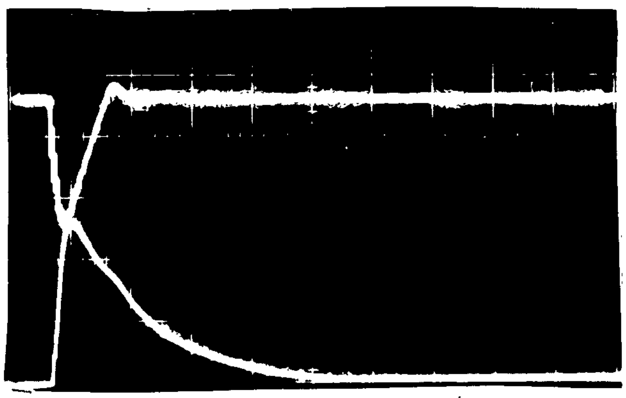
1 ms/cm

Bottom: Current

40 Amp/cm

1 ms/cm

Photo #8 Fig A 1213A Turn-ON at Power Supply Group, Fig A 1289
Fig A 1213B OFF
Fig A 1265 ON
Launch Control Console ON



Top: Voltage

1 volt/cm

1 ms/cm

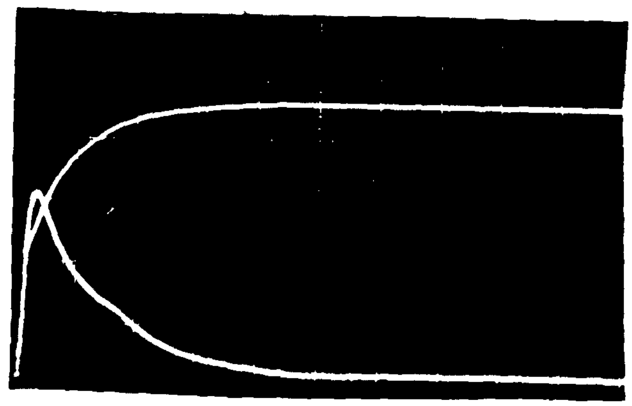
Bottom: Current

40 Amp/cm

1 ms/cm

Photo #9 Fig A 1213A Turn-ON at Power Supply Group, Fig A 1289
Fig A 1213B OFF
Fig A 1265 ON
Launch Control Console OFF

TEST 3.1.1.4



Top: Voltage

10 volt/cm

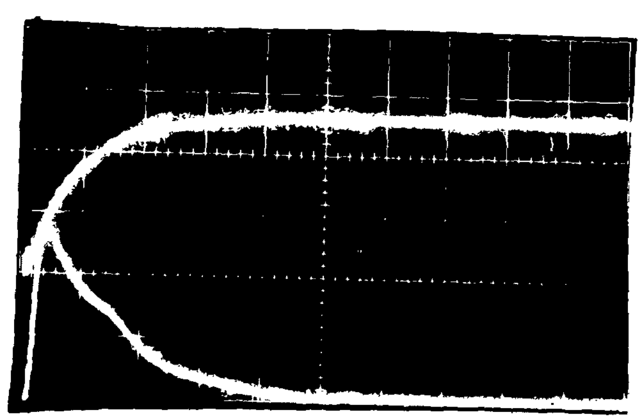
1 ms/cm

Bottom: Current

40 Amp/cm

1 ms/cm

Photo #10 Fig A 1213A Turn-On at Test Points A & B of J2 Drawer A7 of Fig A 1213A
Fig A 1213B ON
Fig A 1265 ON
Launch Control Console ON



Top: Voltage

10 volt/cm

1 ms/cm

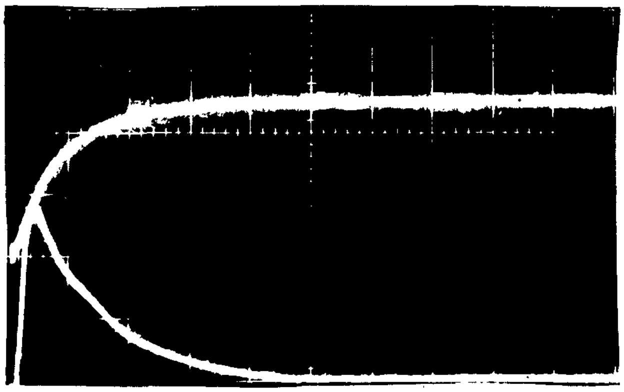
Bottom: Current

40 Amp/cm

1 ms/cm

Photo #11 Fig A 1213A Turn-On at Test Points A & B of J2, Drawer A7 of Fig A 1213A.
Fig A 1213B ON
Fig A 1265 ON
Launch Control Console OFF

TEST 3.1.1.4



Top: Voltage

10 volt/cm

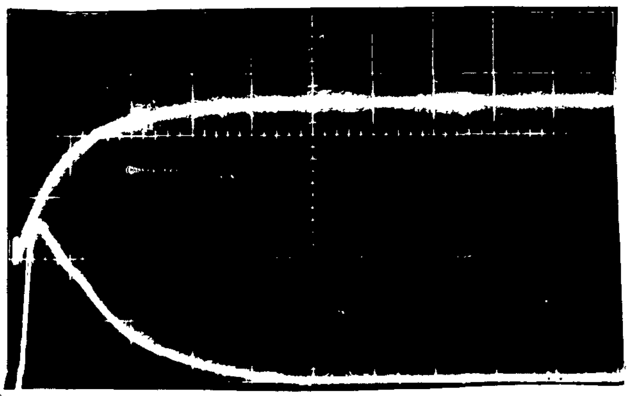
1 ms/cm

Bottom: Current

40 Amp/cm

1 ms/cm

Photo #12 Fig A 1213A Turn ON at Test Points A & B of J2 Drawer A7 of Fig A 1213 A
Fig A 1213B OFF
Fig A 1265 ON
Launch Control Console ON



Top: Voltage

10 volt/cm

1 ms/cm

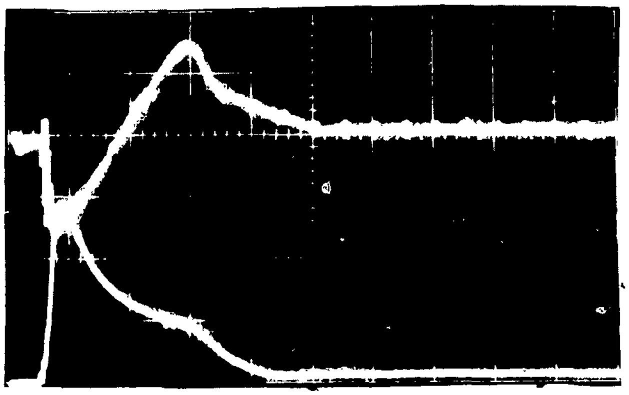
Bottom: Current

40 Amp/cm

1 ms/cm

Photo #13 Fig A 1213A Turn-ON at Test Points A & B of J2 Drawer A7 of Fig A 1213A
Fig A 1213 B OFF
Fig A 1265 ON
Launch Control Console OFF

TEST 3.1.1.4



Top: Voltage

2 volt/cm

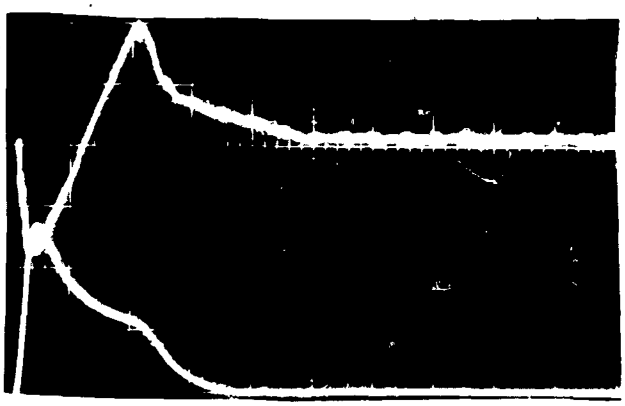
1 ms/cm

Bottom: Current

40 Amp/cm

1 ms/cm

Photo #14 Fig A 1213B Turn ON at Power Supply Group, Fig A 1289
Fig A 1213A and Fig A 1265 ON
Launch Control Console ON



Top: Voltage

2 volt/cm

1 ms/cm

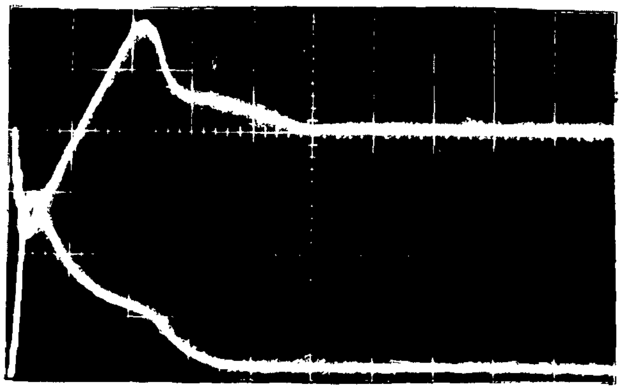
Bottom: Current

40 Amp/cm

1 ms/cm

Photo #15 Fig A 1213B Turn ON at Power Supply Group, Fig A 1289
Fig A 1213A and Fig A 1265 ON
Launch Control Console OFF

TEST 3.1.1.4



Top: Voltage

2 volt/cm

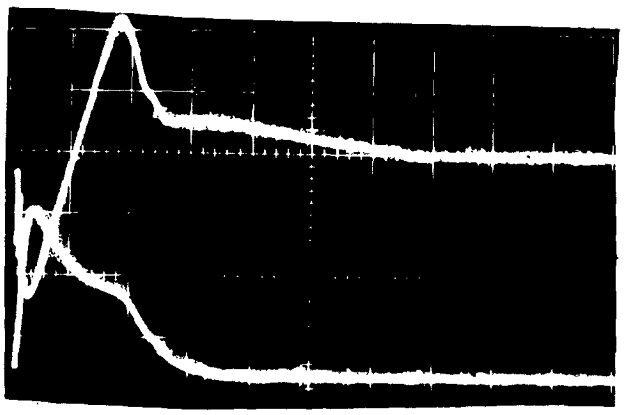
1 ms/cm

Bottom: Current

40 Amp/cm

1 ms/cm

Photo #16 Fig A 1213B Turn ON at Power Supply Group, Fig A 1289
Fig A 1265 ON
Fig A 1213A OFF
Launch Control Console ON



Top: Voltage

2 volt/cm

1 ms/cm

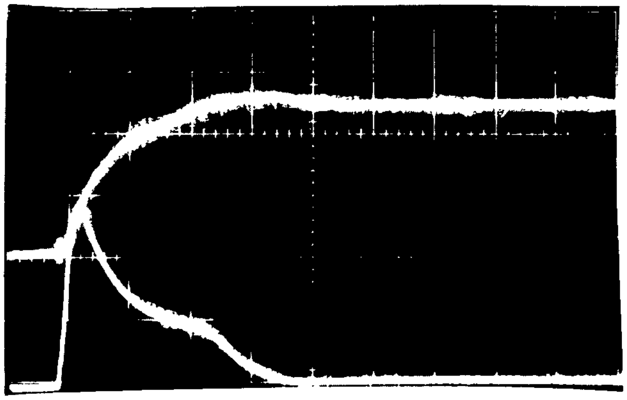
Bottom: Current

40 Amp/cm

1 ms/cm

Photo #17 Fig A 1213B Turn ON at Power Supply Group, Fig A 1289.
Fig A 1265 ON
Fig A 1213 A OFF
Launch Control Console OFF

TEST 3.1.1.4



Top: Voltage

10 volt/cm

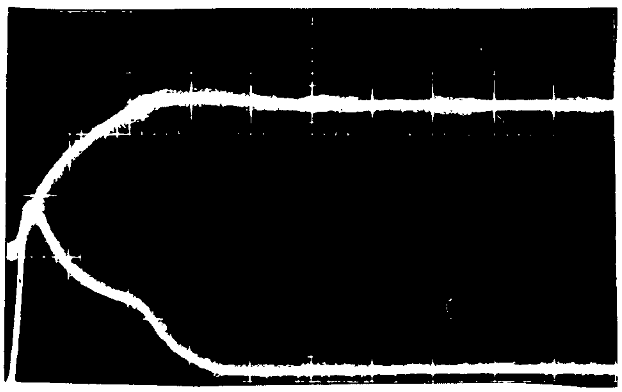
1 ms/cm

Bottom: Current

40 Amp/cm

1 ms/cm

Photo #18 Fig A 1213B Turn ON at Test Points A & B of J2 Drawer A7 of Fig A 1213B.
Fig A 1213A ON
Fig A 1265 ON
Launch Control Console ON



Top: Voltage

10 volt/cm

1 ms/cm

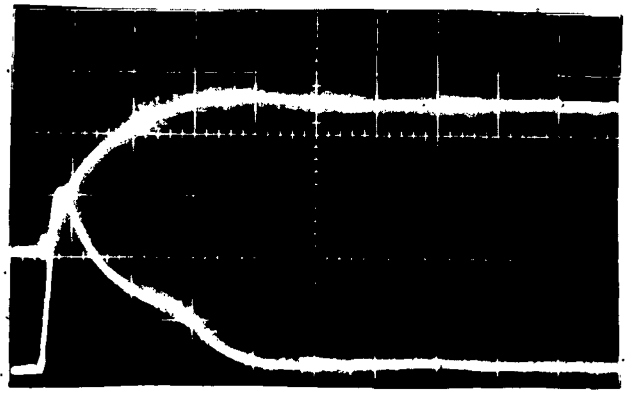
Bottom: Current

40 Amp/cm

1 ms/cm

Photo #19 Fig A 1213B Turn ON at Test Points A & B of J2 Drawer A7 of Fig A 1213B.
Fig A 1213A ON
Fig A 1265 ON
Launch Control Console OFF

TEST 3.1.1.4



Top: Voltage

10 volt/cm

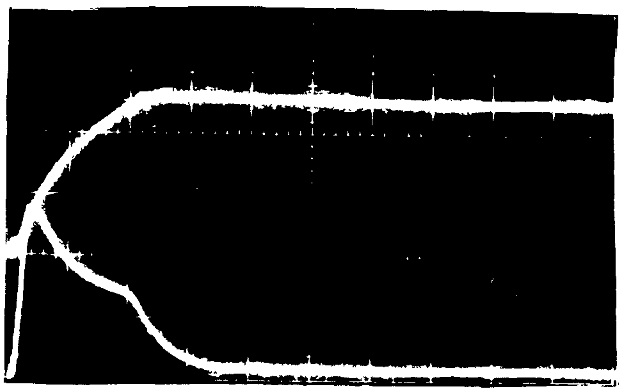
1 ms/cm

Bottom: Current

40 Amp/cm

1 ms/cm

Photo #20 Fig A 1213B Turn-ON at Test Points A & B of J2 Drawer A7 of Fig A 1213B
Fig A 1213A OFF
Fig A 1265 ON
Launch Control Console ON



Top: Voltage

10 volt/cm

1 ms/cm

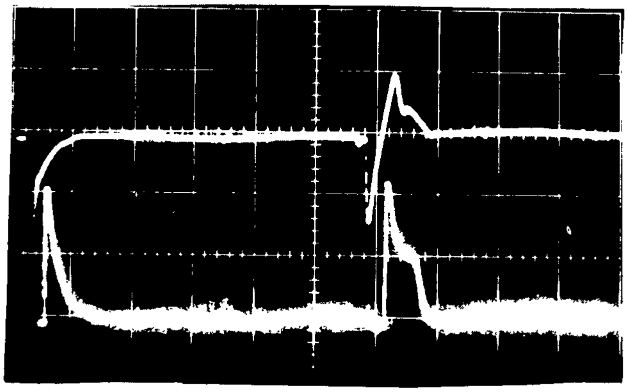
Bottom: Current

40 Amp/cm

1 ms/cm

Photo # 21 Fig A 1213B Turn ON at Test Points A & B of J2 Drawer A7 of Fig A 1213B.
Fig A 1213 OFF
Fig A 1265 ON
Launch Control Console OFF

TEST 3.1.1.4



Top: Voltage at Power Group Output for Figure A 1213A

2 volt/cm

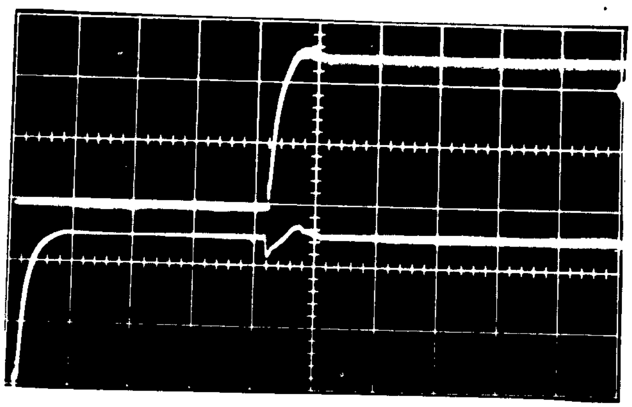
5 ms/cm

Bottom: Current for Fig A 1213A Fig A 1213B, and Fig A 1265

50 Amp/cm

5 ms/cm

Photo #22 Power Group Output when Both Fig A 1213A and 1213B are Turned ON Simultaneously.
Fig A 1265 ON
Launch Control Console ON



Top: Voltage at Test Points A & B of A7, J2, Fig A 1213B

10 volts/cm

5 ms/cm

Bottom: Voltage at Test Points A & B of A7, J2, Fig A 1213A

10 volts/cm

5 ms/cm

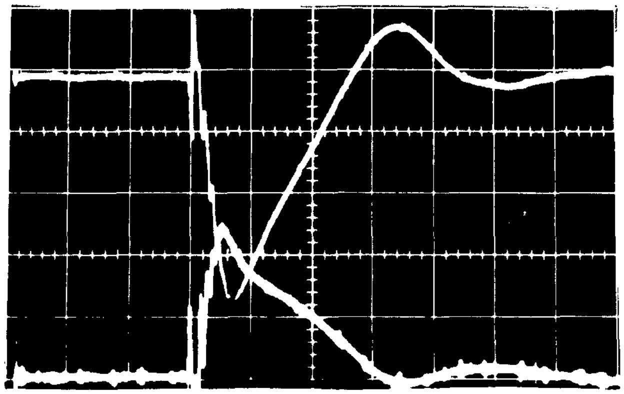
Photo #23 Voltage at SCN Power supplies for A simultaneous Turn ON of Fig A 1213 A & B
Fig A1265 ON
Launch Control Console ON

U3 4288 2000 REV. 8/62

2-5142-2

REV SYM B

TEST 3.1.1.4



Top: Voltage (AC Input)

1 volt/cm

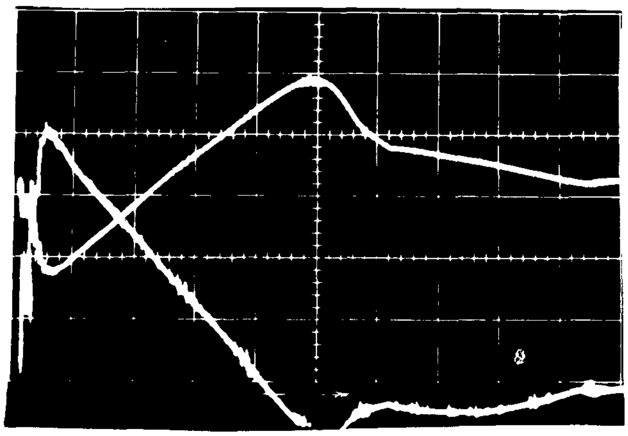
.5 ms/cm

Bottom: Current (AC Input)

.2 Amp/cm

.5 ms/cm

Photo #24 Fig A 1265 Power from Power Supply Group when Fig 1213A is switched ON.
Fig A 1265 ON
Fig A 1213B ON
Launch Control Console ON



Top: Voltage (AC Input)

2 volt/cm

.5 ms/cm

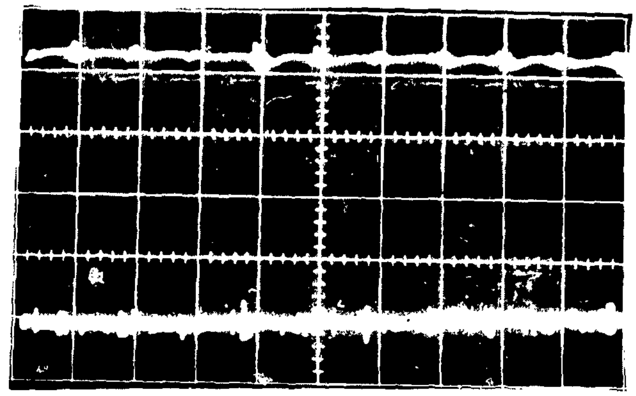
Bottom: Current (AC Input)

.4 Amp/cm

.5 ms/cm

Photo #25 Fig A 1265 Power from Power Supply Group when Fig A 1213B is switched ON
Fig A 1265 ON
Fig A 1213A ON
Launch Control Console ON

TEST 3.1.1.4



Top: Voltage (AC Input)

500 mv/cm

.1 ms/cm

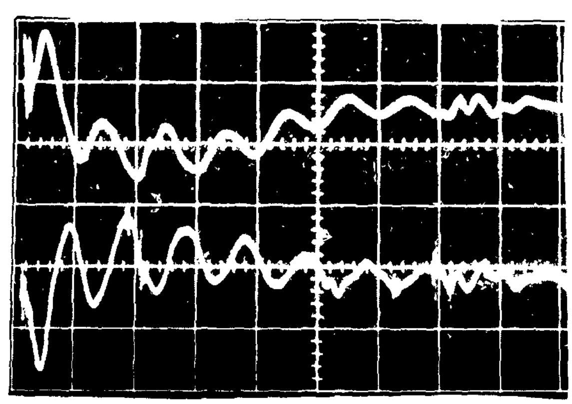
Bottom: Current (AC Input)

.2 Amp/cm

.1 ms/cm

Trigger from Fig A, 1213 A Voltage

Photo #26 Fig A 1265 Power from Power Supply Group when Fig A 1213A is switched OFF
Fig A 1265 ON
Fig A1213B ON
Launch Control Console ON



Top: Voltage (AC Input)

500 mv/cm

.5 ms/cm

Bottom: Current (AC Input)

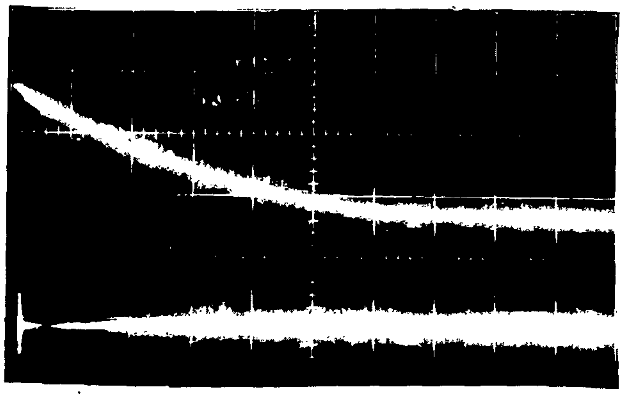
.2 Amp/cm

.5 ms/cm

Trigger from Fig A 1213B Current

Photo #27 Fig A 1265 Power from Power Supply Group when Fig A 1213B is switched OFF
Fig A 1265 ON
Fig A 1213A On
Launch Control Console ON

TEST 3.1.1.4



Top: Voltage

10 volt/cm

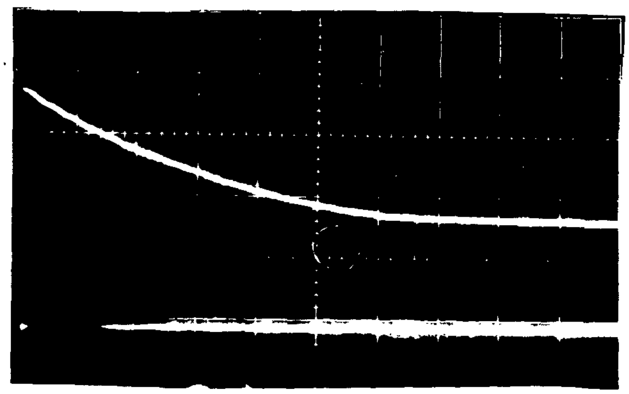
20 ms/cm

Bottom: Current

4 Amp/cm

20 ms/cm

Photo #28 Fig A 1213B Turn-Off at Test Points A & B of J2 Drawer A7 of FigA 1213B
Fig A 1213A ON
FigA 1265 ON
Launch Control Console ON



Top: Voltage

10 volt/cm

20 ms/cm

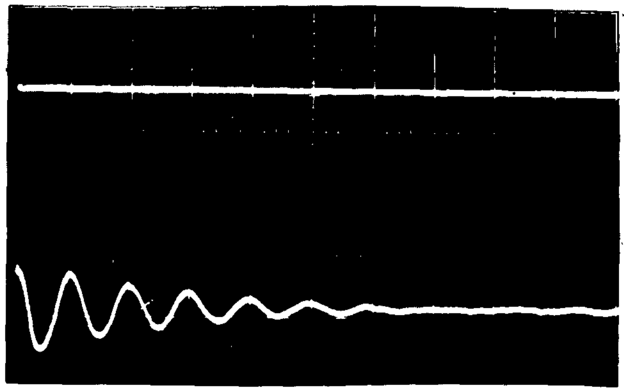
Bottom: Current

4 Amp/cm

20 ms/cm

Photo #29 Fig A 1213 B Turn OFF at Test Points A & B of J2 Drawer A7 of Fig A 1213B
Fig A 1213 OFF
Fig A 1265 ON
Launch Control Console ON

TEST 3.1.1.4



Top: Voltage

10 volt/cm

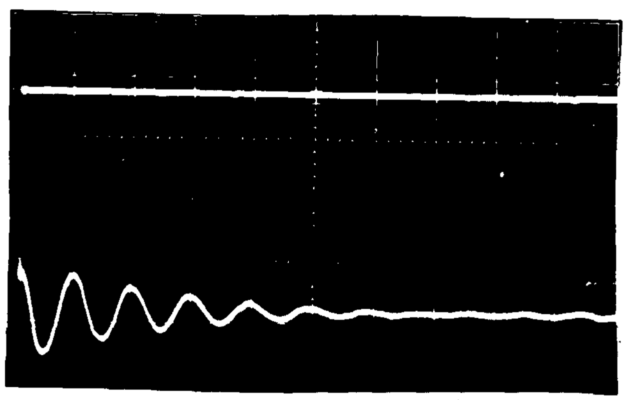
.1 ms/cm

Bottom: Current

4 Amp/cm

.1 ms/cm

Photo #30 Fig A 1213B Turn OFF at Test Points A & B of Drawer A7 of Fig A 1213B
Fig A 1213A OFF
Fig A 1265 ON
Launch Control Console ON



Top: Voltage

10 volt/cm

.1 ms/cm

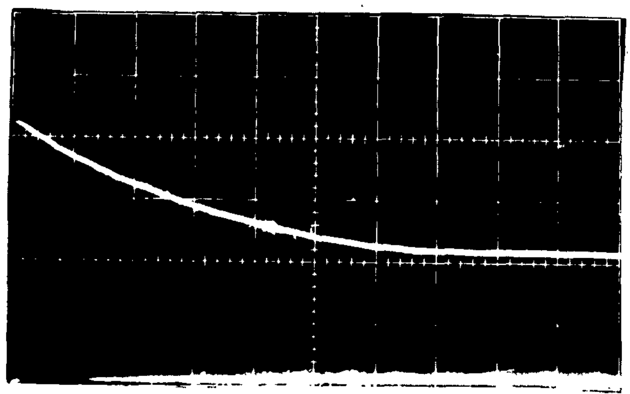
Bottom: Current

4 Amp/cm

.1 ms/cm

Photo #31 Fig A 1213B Turn-OFF at Test Points A & B of Drawer A7 of Fig A 1213B
Fig A 1213A OFF
Fig A 1265 ON
Launch Control Console OFF

TEST 3.1.1.4



Top: Voltage

10 volt/cm

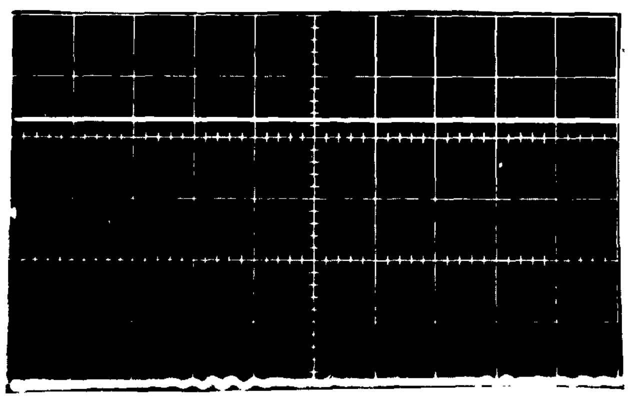
20 ms/cm

Bottom: Current

4 Amp/cm

20 ms/cm

Photo #32 Fig A 1213A Turn OFF at Test Points A & B of J2 Drawer A7 of Fig A 1213A
Fig A 1213B ON
Fig A 1265 ON
Launch Control Console ON



Top: Voltage

10 volt/cm

.1 ms/cm

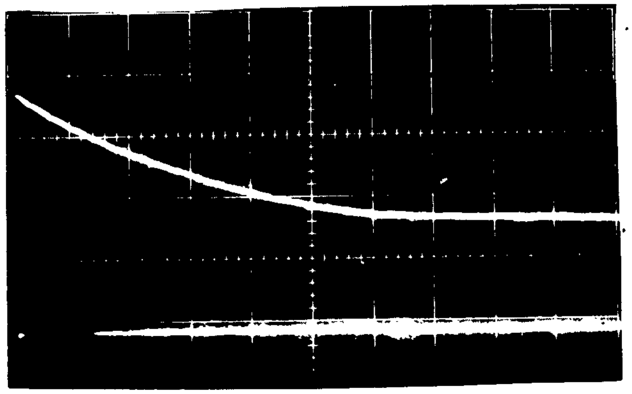
Bottom: Current

4 Amp/cm

.1 ms/cm

Photo #33 Fig A 1213 A Turn-OFF at Test Points A & B of J2 Drawer A7 of Fig A 1213A
Fig A 1213B OFF
Fig A 1265 ON
Launch Control Console OFF

TEST 3.1.1.4



Top: Voltage

10 volts/cm

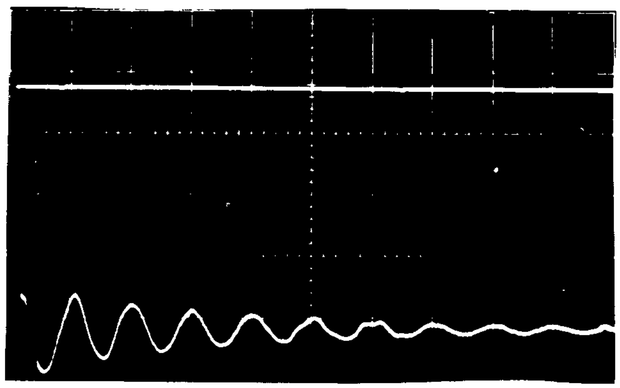
20 ms/cm

Bottom: Current

4 Amp/cm

20 ms/cm

Photo #34 Fig A 1213B Turn OFF at test Points A & B of J2 Drawer A7 of Fig A 1213B
Fig A 1213A OFF
Fig A 1265 ON
Launch Control Console OFF



Top: Voltage

10 volt/cm

.1 ms/cm

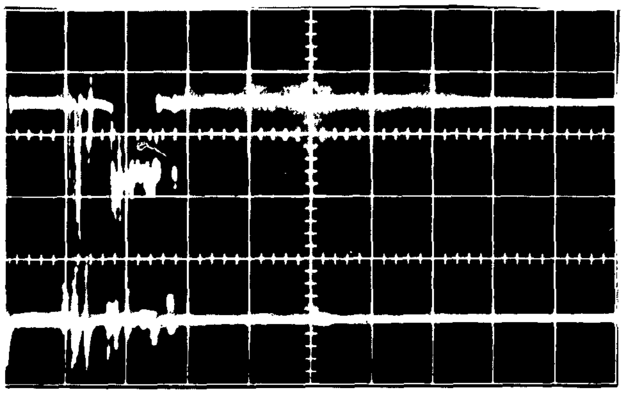
Bottom: Current

4 Amp/cm

.1 ms/cm

Photo #35 Fig A 1213B turn OFF at Test Points A & B of J2 Drawer A7 of Fig A 1213B
Fig A 1213A ON
Fig A 1265 ON
Launch Control Console ON

TEST 3.1.1.4



Top: Voltage

10 volt/cm

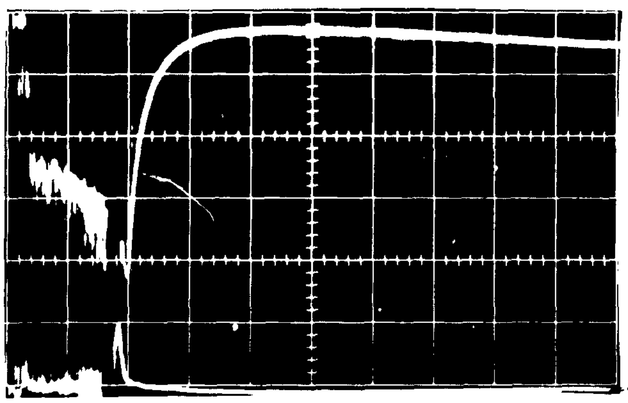
.1 ms/cm

Bottom: Current

40 Amp/cm

.1 ms/cm

Photo #36 Fig A 1265 Turn ON at Power Supply Group with Fig A 1213A & Fig A 1213B OFF
Launch Control Console OFF



Top: Voltage

10 volt/cm

.1 ms/cm

Bottom: Current

40 Amps/cm

.1 ms/cm

Photo #37 Fig A 1265 Turn OFF at Power Supply Group with Both Fig A 1213A & Fig A 1213B OFF
Launch Control Console OFF

TEST REPORT 3.1.1.5

1. TITLE

Communication Control Console Load Test

2. OBJECTIVE

To determine the DC Power requirements of the CCC Arming and Status Panel.

3. CONCLUSIONS

Steady-State current requirements of the Arming and Status Panel of the Communications Control Console were lower than stated in D2-4853-2, which shows an average load of 1.0 amps. The measured load was 57 ma.

4. EQUIPMENT IN TEST

Communication Control Console P/N 25-27095-5 S/N 0000005

5. TEST DESCRIPTION

5.1 The equipment was connected per Figure 3.0.0.0-1 and Figure 3.1.1.5-1

5.2 Volume control on the Arming and Status Panel was turned to maximum, and the LF Selector was set to the OFF position.

5.3 Equipment was turned on and data was taken at the LF Power Supply Group.

5.4 A simulated VRSA Signal was sent to the Status and Arming Panel of the CCC, and power measurements were repeated.

6. TEST SUMMARY

6.1 Photographs of ripple, and on-off transients are attached.

6.2 The two photographs of the ripple content of the Arming and Status Panel show no difference when a simulated VRSA Signal is fed to the input of the Panel.

6.3 Turn on voltage transient is 20 V.

Turn on Current transient is 3.8 Amps.

6.4 Steady State Voltage is 27.413 Volts

Steady State Current is 57 Milliamperes.

6.5 Steady State Voltage and Current requirements are not changed when tone is applied to the input of the Arming and Status Panel.

7. GENERAL INFORMATION

7.1 Test Engineer: Richard Mathias

7.2 Date Test Completed: 4/23/63

7.3 Applicable E R's None

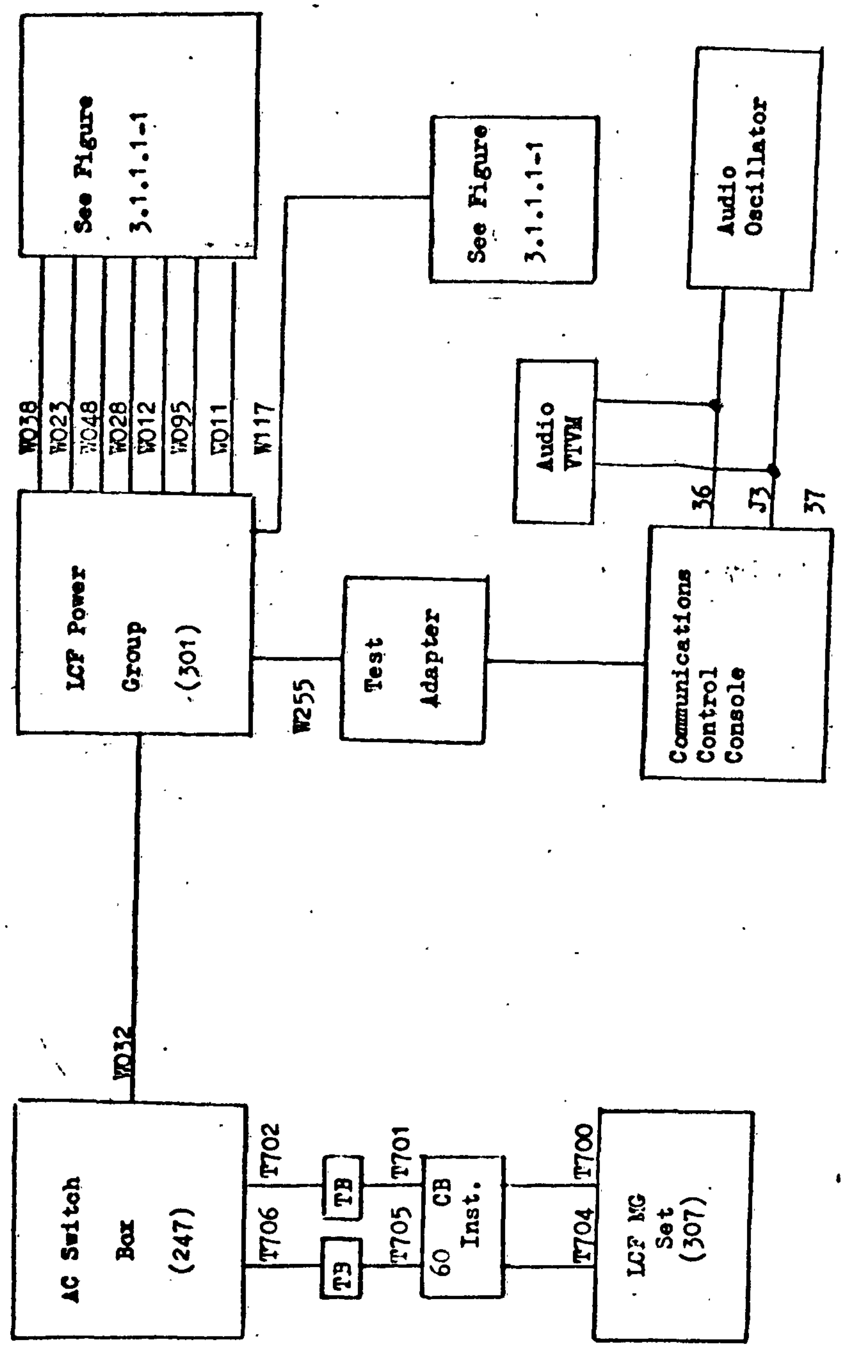


Figure 3.1.1.5-1

TEST 3.1.1.5

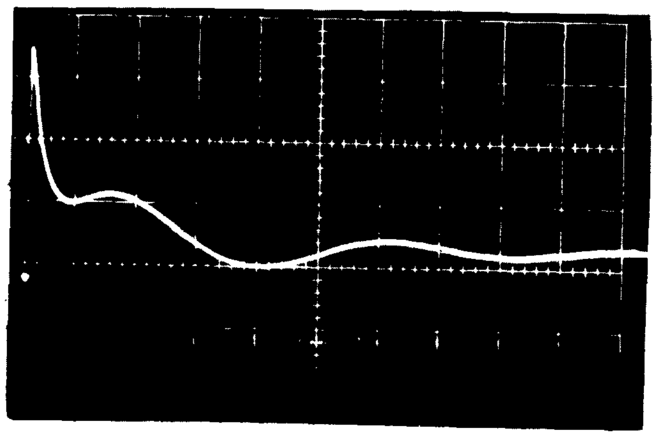


Photo #1

Turn-on Transient

Top Trace

Current (AC Input)

Scale: 10 Amps/CM

Sweep: 1 MS/CM

Bottom Trace

Voltage

Scale: 20 V/CM

Sweep: 1 μs/cm

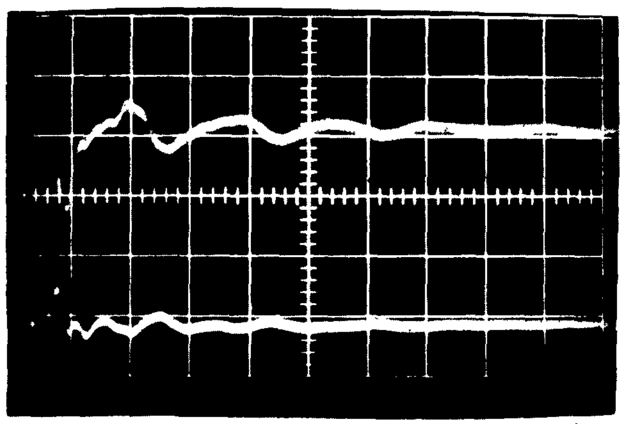


Photo #2

Turn-off Transient

Top Trace

Current (AC Input)

Scale: 200 ma/cm

Sweep: 1 μs/cm

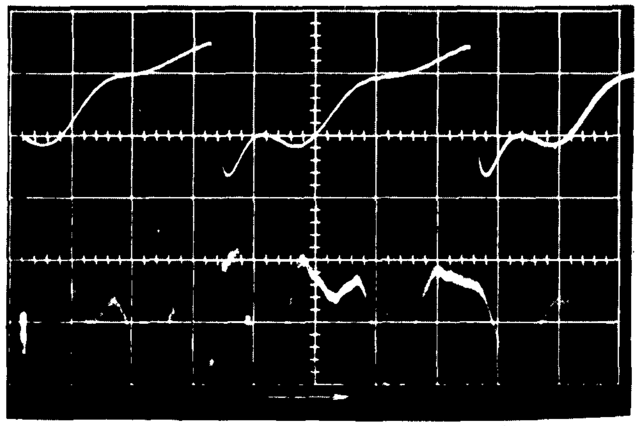
Bottom Trace

Voltage

Scale: 10 v/cm

Sweep: 1 μs/cm

TEST 3.1.1.5



Ripple (No Tone In)

Top Trace

Current

Scale: 50 ma/cm

Sweep: 2 ms/cm

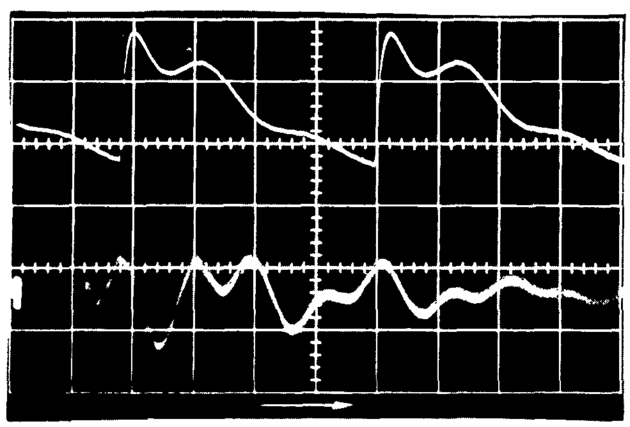
Bottom Trace

Voltage

Scale: 50 mv/cm

Sweep: 1 µs/cm

Photo #3



Ripple (Tone In)

Top Trace (Polarity Reversed)

Current

Scale: 50 ma/cm

Sweep: 2 ms/cm

Bottom Trace

Voltage

Scale: 50 mv/cm

Sweep: 1 µs/cm

Photo #4

TEST REPORT 3.1.1.6

1. TITLE

SAC/CTE Load Test

2. OBJECTIVE

To determine the power requirements of the SAC/CTE.

3. CONCLUSIONS

The SAC/CTE power requirements are as defined in this report.

4. EQUIPMENT IN TEST

Repeater Telephone Set P/N 8319702-502, S/N 0000001.

5. TEST DESCRIPTION

5.1 The equipment was connected as shown in Figure 3.0.0.0-1 and 3.1.1.6-1, except the 465L racks were not present. Cable W152 was not connected to 465L rack #3.

5.2 The voltage and current for the SAC/CTE was observed by use of the Breakout Box for the LCF power group. Ripple was also observed at this location.

5.3 The 48 ampere supply was not present in the Power Group at the time that this test was conducted. This should not have affected test results, however.

6. SUMMARY OF TEST RESULTS

6.1 *PAS Panel Power requirements are:

Steady State Voltage +28.052 VDC

Steady State Current 21 ma

Steady State Power .589 Watts

Turn on Voltage Transient 60 Volts

* See Photos #1 through #14

Turn on Current Transient 3 Amps

Turn off Voltage Transient .25 Volt

Turn off Current Transient .2Amps

6.2 *SAC/CTE Power requirements are:

Steady State Voltage +28.038 VDC

Steady State Current 30 ma

Steady State Power .841 Watt

Turn on Voltage Transient 30 Volt

Turn on Current Transient 4 Amps

Turn off Voltage Transient 0 Volts

Turn off Current Transient 1 Amp

6.3 *Interacting transients between SAC/CTE and the PAS Panel are:

Transients in SAC/CTE supply line due to switching on and off

PAS Panel:	On	10 Volts	.03Amps
	Off	20 Volts	.15Amps

Transients in PAS Panel supply line due to switching on and off

SAC/CTE:	On	20 Volts	.2 Amps
	Off	20 Volts	.2 Amps

6.4 *Ripple in Pas Panel Supply Line is:

Voltage	25 mv
Current	15 ma

Ripple in SAC/CTE Supply Line is:

Voltage	15 mv
Current 1	13 ma

6.5 No audible noise was observed on the PAS speakers when switching on or off the SAC/CTE.

* Photographs are attached.

U3 4288 2000 REV. 8/62

2-5142-2

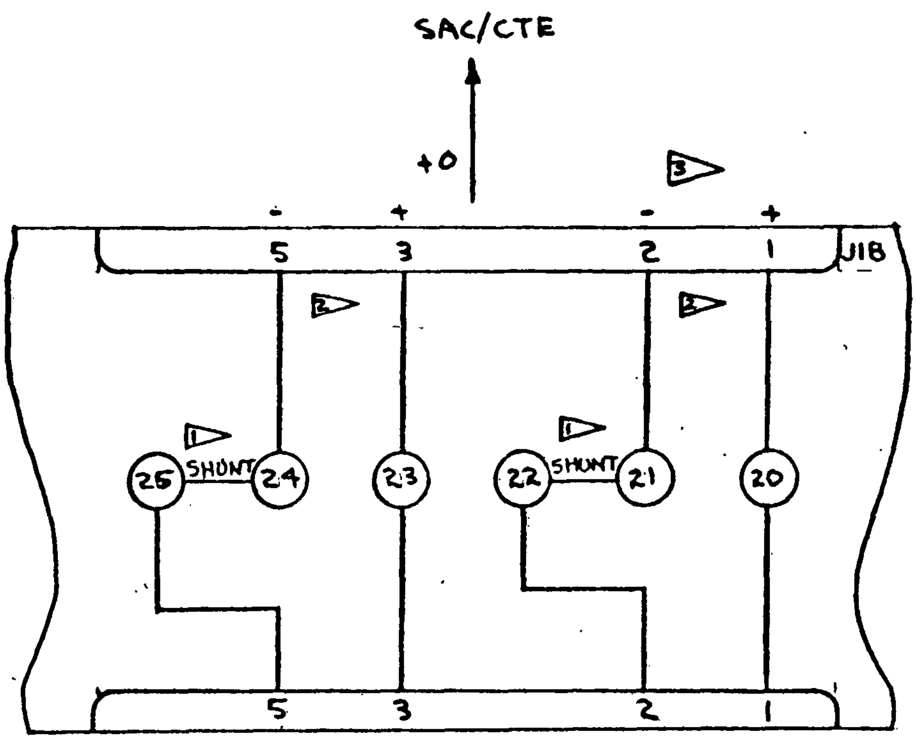
REV SYM B

7. <u>GENERAL INFORMATION</u>

7.1 Test Engineer: Richard Mathias

7.2 Date Test completed: 4/22/63

7.3 Applicable E R's: None



FIG, A 1289 BREAKOUT BOX

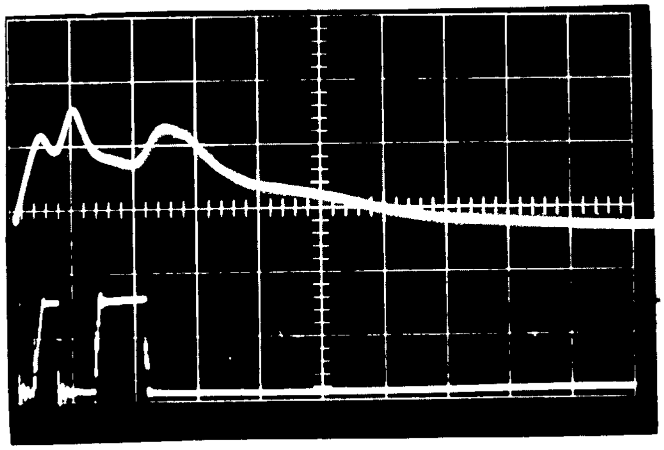
1 USE 1 AMP SHUNTS

2 VOLTAGE MONITOR POINT

3 ROUTED THROUGH FILTER IN SAC/CTE TO THE PAS PANEL

FIGURE 3.1.1.6-1

TEST [illegible].1.1.6



Top Trace

Current Transient

2 amps/cm

5 ms/cm

Bottom Trace

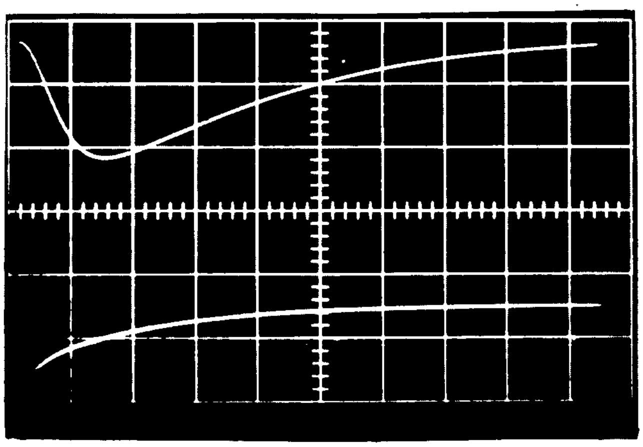
Voltage Transient

20 volts/cm

0.1 ms/cm

Photo #1 Turn-on Transient of SAC/CTE with PAS Panel on

Monitor point: Figure A 1289 Breakout Box, pins 3 & 5.



Top Trace

Current Transient

0.5 amps/cm

0.2 ms/cm

Bottom Trace

Voltage Transient

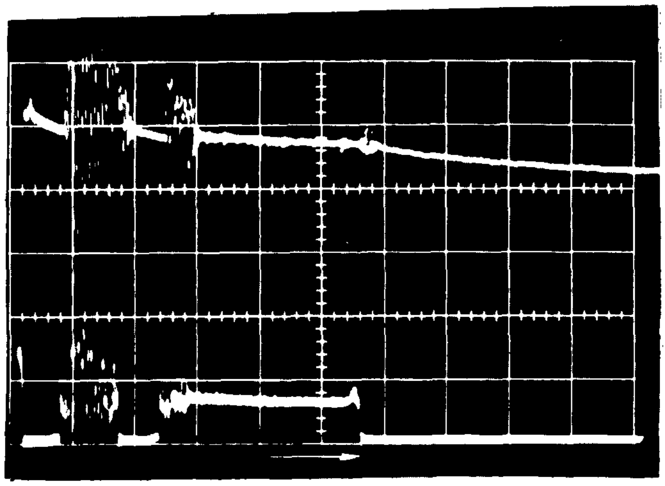
20 volts/cm

0.2 ms/cm

Photo #2 Turn-off Transient of SAC/CTE with PAS Panel off

Monitor point: Figure A 1289 Breakout Box, pins 3 & 5.

Test 3.1.1.6



Top Trace

Current Transient

1 amp/cm

$20\ \mu sec/cm$

Bottom Trace

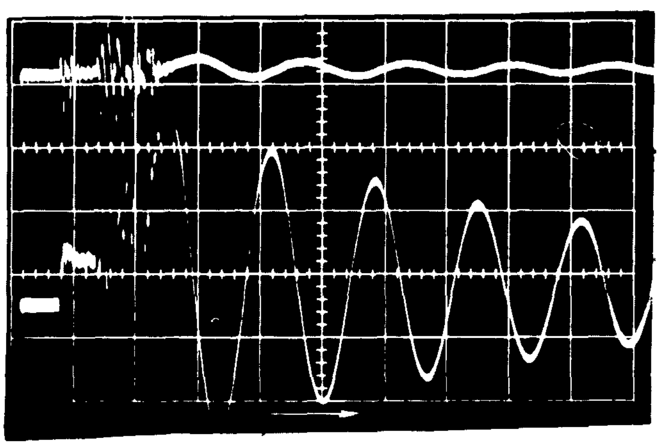
Voltage Transient

20 volts/cm

$20\ \mu sec/cm$

Photo #3 Turn-on Transient of PAS Panel with SAC/CTE on.

Monitor point : Figure A 1289 Breakout Box, pins 1 & 2 (Photos # 3, 4, 5 and 6)



Top Trace

Current Transient

0.1 amp/cm

$5\ \mu sec/cm$

Bottom Trace

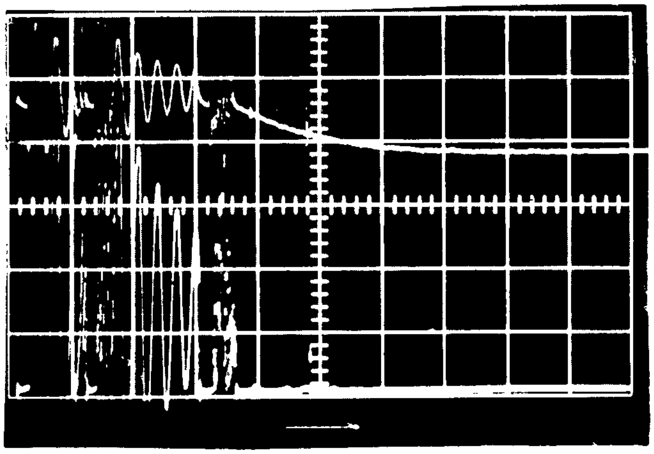
Voltage Transient

.05 volt/cm

$5\ \mu sec/cm$

Photo #4 Turn-off Transient of PAS Panel with SAC/CTE on

TEST 3.1.1.6



Top Trace

Current

1 amp/cm

.1 ms/cm

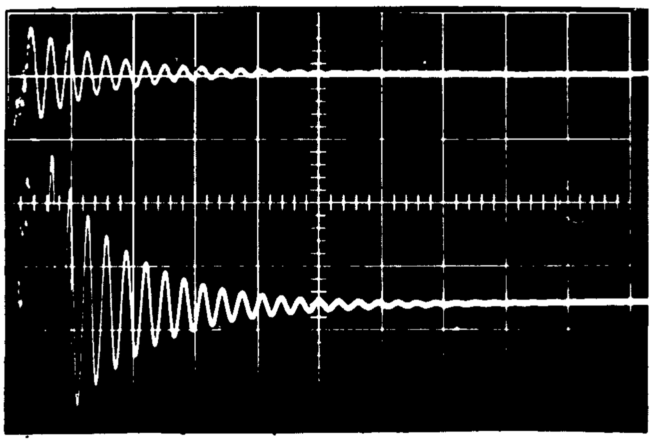
Bottom Trace

Voltage

20 volts/cm

Photo #5 PAS Panel on Transient

with SAC/CTE on



Top Trace

Current

1 amp/cm

.1 ms/cm

Botton Trace

Voltage

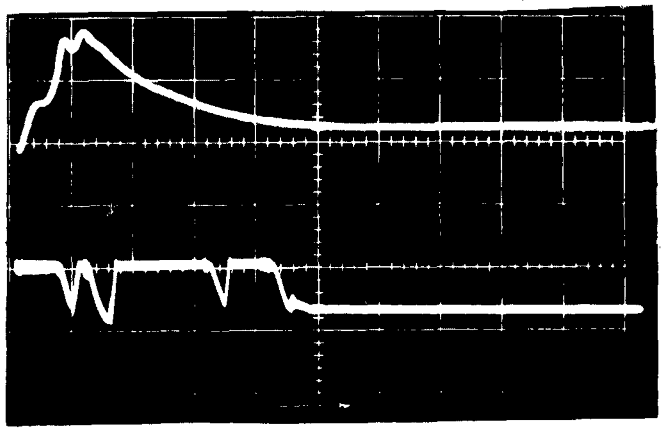
20 volts/cm

.1 ms/cm

Photo #6 Pas Panel off Transient

with SAC/CTE on

TEST 3.1.1.6



Top Trace

Current

0.5 amp/cm

10 ms/cm

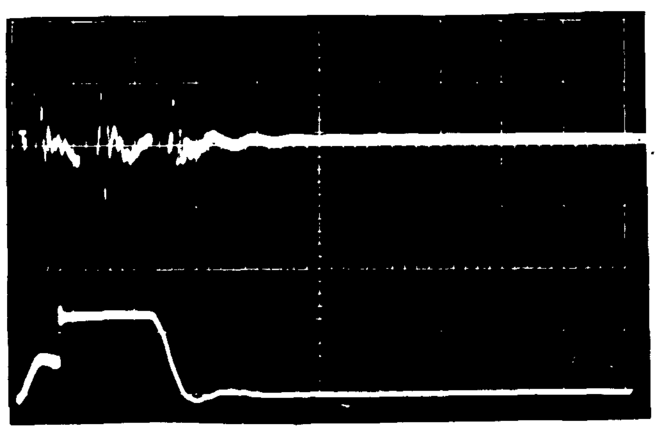
Bottom Trace

Voltage

20 volts/cm

.1 ms/cm

Photo 7 Turn on Transient of SAC/CTE with PAS Panel off



Top Trace

Current

.5 amp.cm

5 μs/cm

Bottom Trace

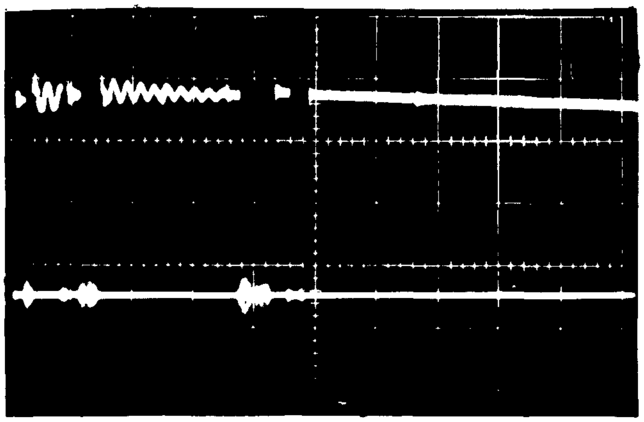
Voltage

20 volts/cm

.1 ms/cm

Photo #8 Turn off of SAC/CTE with PAS Panel off

TEST 3.1.1.6



Top Trace

Current

.01 amps/cm

.1 ms/cm

Bottom Trace

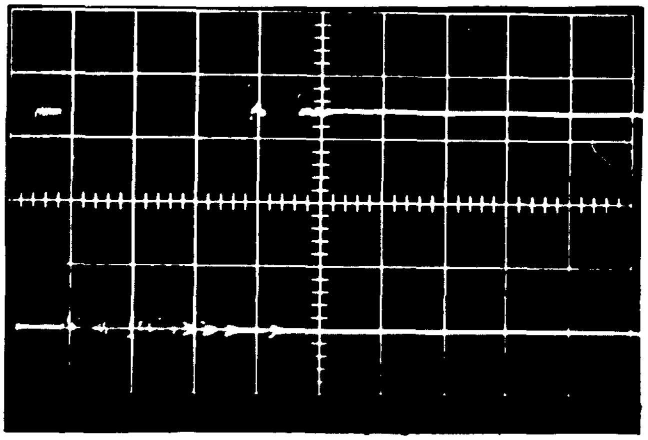
Voltage

10 volts/cm

.1 ms/cm

Photo #9 SAC/CTE Power while

PAS Monitor panel is switched on.



Top Trace

Current

.05 amps/cm

10 μs/cm

Bottom Trace

Voltage

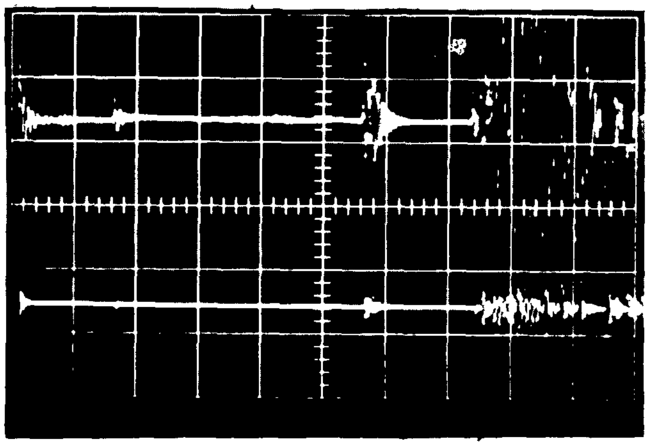
20 v/cm

10 μs/cm

Photo #10 SAC/CTE Power while

PAS Monitor Panel is switched off

TEST 3.1.1.6



Top Trace

Current (AC Input)

.05 amps/cm

20 μs/cm

Bottom Trace

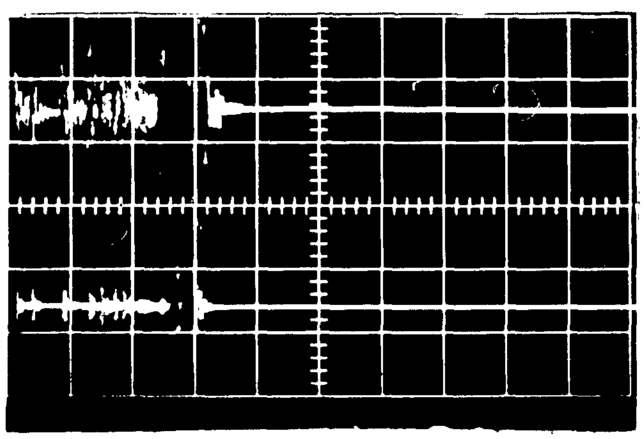
Voltage

10 volt/cm

20 μs/cm

Photo #11 PAS Panel Power while switching SAC/CTE on

Monitor point: Figure A 1289 Breakout Box, pins 1 & 2 (Photos # 11, 12, 14 & 15)



Top Trace

Current (AC Input)

.05 amps/cm

20 μs/cm

Bottom Trace

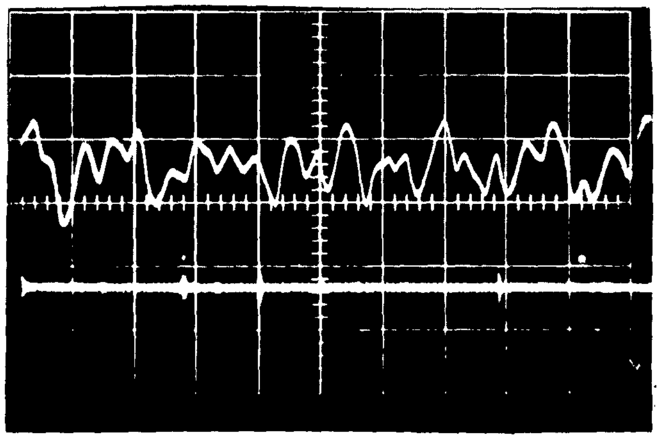
Voltage

10 volts/cm

20 μs/cm

Photo #12 PAS Panel Power while switching SAC/CTE off

TEST 5.1.1.5



Top Trace

Current

.01 amps/cm

.2 ms/cm

Bottom Trace

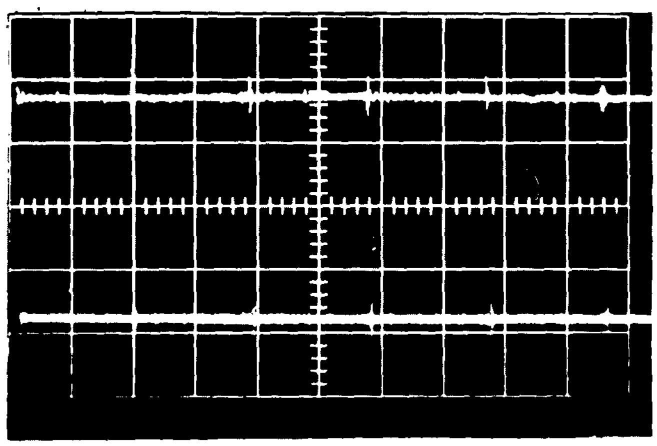
Voltage

.05 volts/cm

.1 ms/cm

Photo #13 Ripple on SAC/CTE with

FAS Panel on



Top Trace

Current (AC Input)

.01 amp/cm

.2 ms/cm

Bottom Trace

Voltage

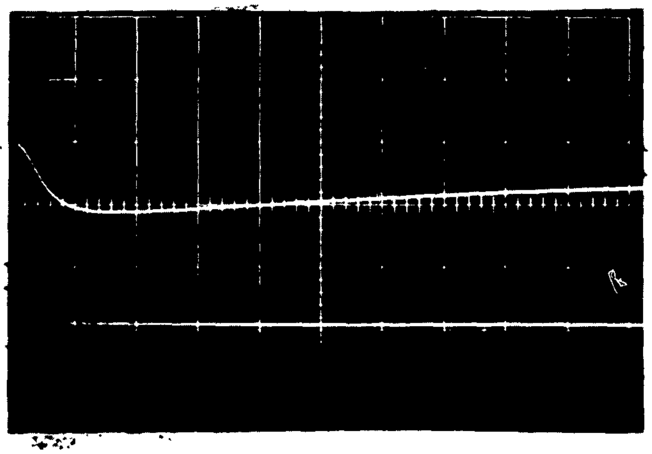
.05 volt/cm

.2 ms/cm

Photo #14 Ripple on FAS Panel with

SAC/CTE on

TEST 3.1.1.6



Current Transient
0.4 amp/cm
1 ms/cm

Voltage
0.05 v/cm
1 ms/cm

Photo #15 Turn-on transients of PAS Supply when turning on PAS Speaker

TEST REPORT 3.1.1.7

1. Title

Telephone Connecting and Switching Set Load Test

2. Objective

To determine the 60 cps power requirements of the Telephone Connecting and Switching Set (TCSS).

3. Conclusions

3.1 It was verified that the maximum load of the TCSS is an input of approximately 2.05 amperes RMS.

3.2 The TCSS is overloaded when all 10 LF lines are flashing and VHF Radio is energized. Maximum load is attained when the 10 LF lines, DIAL Lines 1 and 2, EW01 and SCC Circuitries are energized; further loading will blow fuse F4 in the Power Supply Drawer.

3.3 No voltage transients existed when the TCSS was turned on and when it was turned off.

4. Equipment in Test

4.1 Telephone Connecting and Switching Set P/N 1274180 S/N 0000006

4.2 Telephone Transmitter Control C-3937/GTC P/N 1274013-503

4.3 Telephone Transmitter Control C-3937/GTC P/N 1274013-503 S/N 0000004

5. Test Description

5.1 The equipment was connected per Figure 3.1.1.7-1

5.2 The TTC's at the LCC and CCC were verified to have no buttons pushed in. With the TCSS in no-load condition, voltage, current and power measurements were taken.

5.2 (continued)

5.2.1 116.3 volts

5.2.2 1.72 amperes

5.2.3 163 watts

5.3 Photographed input voltage and current waveforms, also the current turn-on transient. Voltage transients were negligible.

5.3.1 Photo #1 taken of input voltage waveform.

5.3.2 Photo #2 taken of input current waveform across a 5 amperes 50 mv shunt.

5.3.3 Photo #3 taken of current turn-on transient.

5.3.4 No photograph taken of current turn-off since it was negligible.

5.3.5 Photo #4 taken of input voltage with the TCSS Power Switch off.

5.4 Signal tones were applied per Figure 3.1.1.7-1 to LF2, LF3, DIAL LINE 1, DIAL LINE 2, EWO1, and VHF. At the LCC, depressed upper OPR, DIAL LINE 1, and LF 2 buttons. At the CCC, depressed lower OPR, DIAL LINE 2, VHF and LF 3 buttons.

5.5 Lifted LCF wall phone off hook to initiate SCC ringing at the LCC and CCC. The SCC button was depressed at the LCC to cut-off the ringing.

5.6 Measured voltage, current and power.

5.6.1 116.1 volts.

5.6.2 2.02 amperes

5.6.3 210 watts

5.7 Photographed input voltage and current turn-on transient.

5.7.1 Photo #5 taken of input voltage waveform.

5.7.2 Photo #6 taken of current turn-on transient.

5.8 At the LCC, depressed EW01 instead of DIAL LINE 1. No change in measurements were observed.

5.9 Removed all loads from TCSS and then proceeded to measure current under the following progressive conditions:

5.9.1	Under no load	1.75 amps
5.9.2	Depress upper OPR at LCC	1.77 amps
5.9.3	Depress lower OPR at CCC	1.78 amps
5.9.4	Depress LF2 and LF3	1.91 amps
5.9.5	Depress DIAL LINE 1	1.94 amps
5.9.6	Depress DIAL LINE 2	1.98 amps
5.9.7	Depress SCC	2.03 amps
5.9.8	Depress VHF	2.04 amps

5.10 Measurements were taken with flasher not activated since activation of flasher causes meters to oscillate between maximum and minimum. Overshoot of the meters makes accurate measurements impossible.

5.11 Removed all loads from TCSS and adjusted oscillator #1 and 2 until LF2 through LF11 began flashing.

5.12 Adjusted oscillator #3 to 1 kc and +3 dbm to apply tone to VHF. Failure occurred, the LF2 through LF11 lamps quit flashing and remained off. Investigation revealed that fuse F4 in the Power Supply Drawer blew. The fuse was replaced and tone was again applied to LF2 through LF11 successfully.

5.13 Monitored flasher output on A4J3-p referenced to signal return on TCSS J7-68. Photo #7 was taken of the flasher output which shows a clean square wave output without noise spikes between level changes.

5.14 Monitored the input current across the 5 amp shunt. Photo #8 was taken using a double exposure in order to show how the waveform changes when flasher goes on-off.

5.15 Adjusted oscillator #4 to 1 kc and -10 dbm to apply tone to EW01, DIAL LINE 1 and DIAL LINE 2.

5.16 Depressed OPR and EW01 at the CCC and OPR and DIAL LINE 2 at the CCC. Removed phone off hook at the CCC.

5.17 The input current measured approximately 2.05 amperes maximum.

5.18 Lifted the LCF wall phone to start SCC ringing at the TTC's. The LF lamps immediately stopped flashing and remained off. A check revealed that the F4 fuse blew again.

6. Summary of Test Results

6.1 See Table 3.1.1.7-1 for tabulation of measurements taken.

6.2 Photographs #1 through #8 taken during the test.

7. General Information

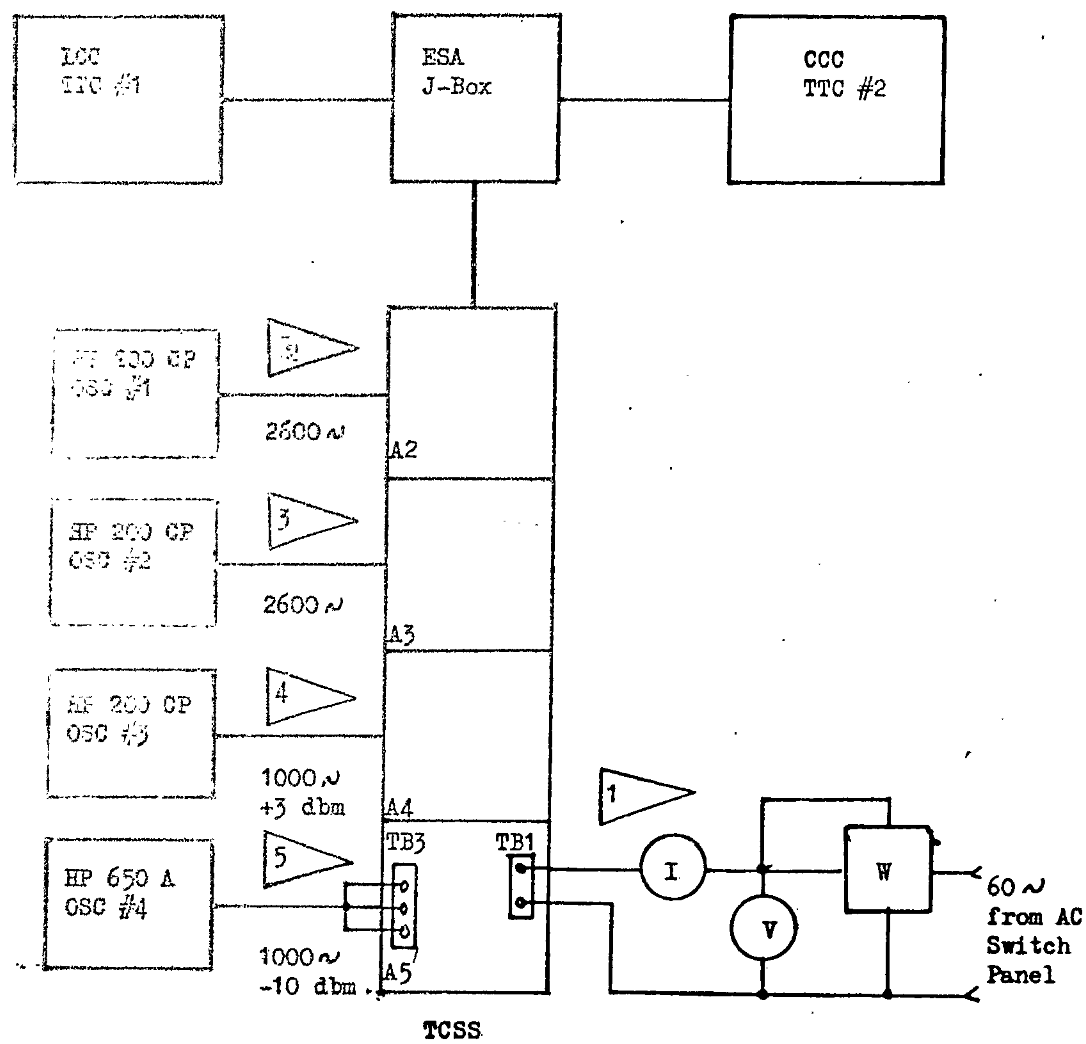
7.1 Test Engineer: Fred Shigemi, Dept. 2-6519-14.

7.2 Test completed on: 20 May 1963.

7.3 Applicable ER's: U147253 U093896
U093900 U093917
U093898 U093916

	Condition	Voltage	Current	Power	P. F.
1	All Buttons Out T-TC, No Inputs	116.3	1.72	163	.813
2	Inputs Per Fig. 3.1.1.7-1 OPR, LF2, Dial Line #1	116.1	2.02	210	.902
3	No Load		1.75		
4	Upper OPR on LCC Depressed		1.77		
5	Lower OPR on CCC Depressed		1.78		
6	LF2 at LCC and LF3 at CCC Depressed		1.91		
7	Dial Line #1 at LCC Depressed		1.94		
8	Dial Line #2 at CCC Depr.		1.98		
9	Depressed SCC on LCC (Wall Phone Removed)		2.03		
10	Depressed VHF on CCC		2.04		

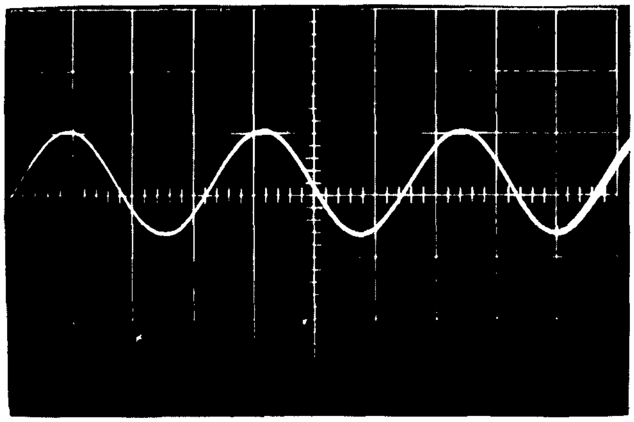
TABLE 3.1.1.7-1



1. I and V are also monitor points for oscilloscope. Replace ammeter with 5 amp 50 mv shunt to monitor current with scope.
2. SIN inputs, LF2 thru LF6, on A2J3-M,P,S,U,W (Returns on A2J3-L,N,R, T,V respectively).
3. SIN inputs, LF7 thru LF11, on A3J3-M,P,S,U,W (Return on A3J3-L,N,R, T,V respectively).
4. VHF input on A4J3-u (-t Return).
5. EWO1 input on TB3-7 (-8 Return), DIAL LINE 1 on TB 3-1 (-2 Return) and DIAL LINE 2 on TB3-5 (-6 Return).

FIGURE 3.1.1.7-1 TCSS Load Test Configuration

TEST 3.1.1.7



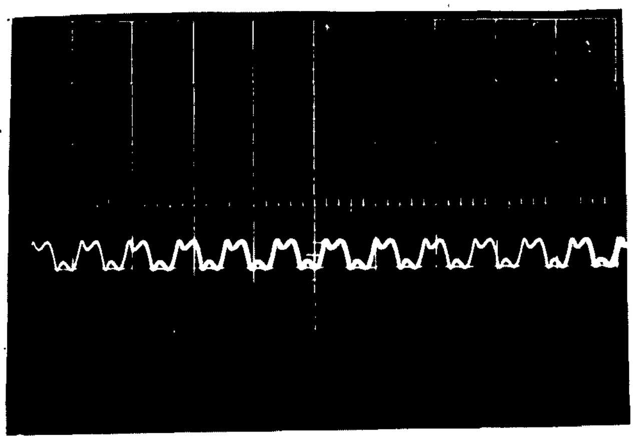
20 volts/cm

5 ms/cm

Photo #1 60 cps power input voltage waveform

10x1 attenuator probe used.

TCSS power switch on.



Diff. Preamp.

input across A-B

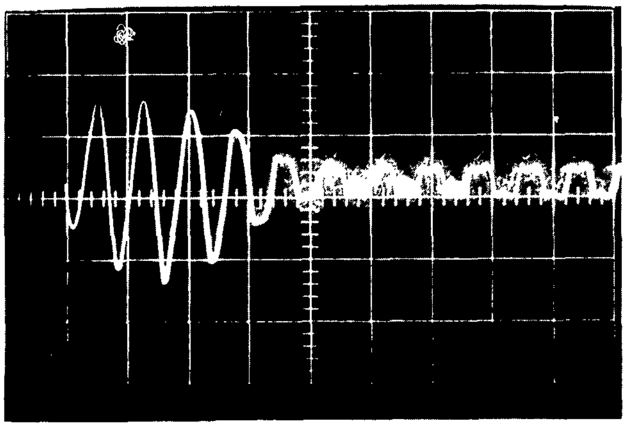
50 mv/cm

20 ms/cm

Photo #2 60 cps power input current

waveform across shunt (5 amp, 50 mv)

TEST 3.1.1.7

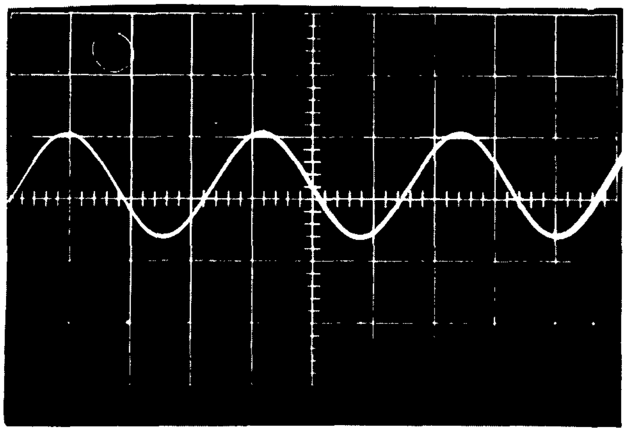


50 mv/cm

20 ms/cm

Photo #3 Current Turn-on transient

Shunt input across A-B



20 volts/cm

5 ms/cm

Photo #4 Input voltage with TCSS

rower switch off.

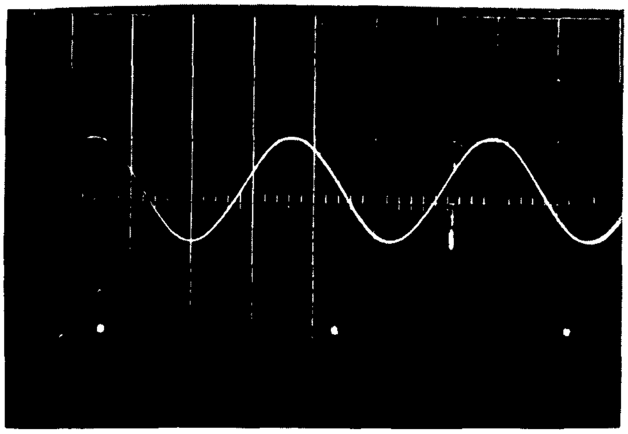
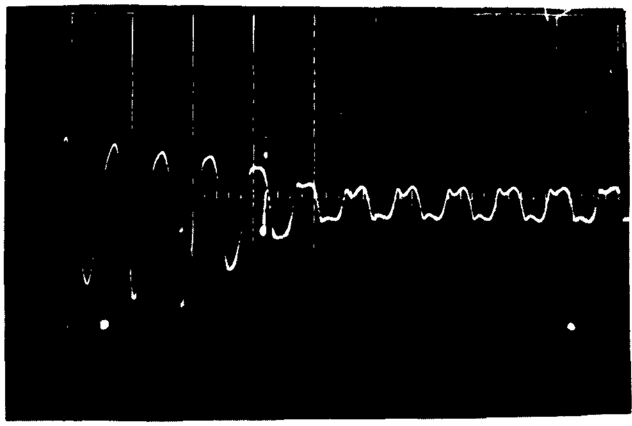


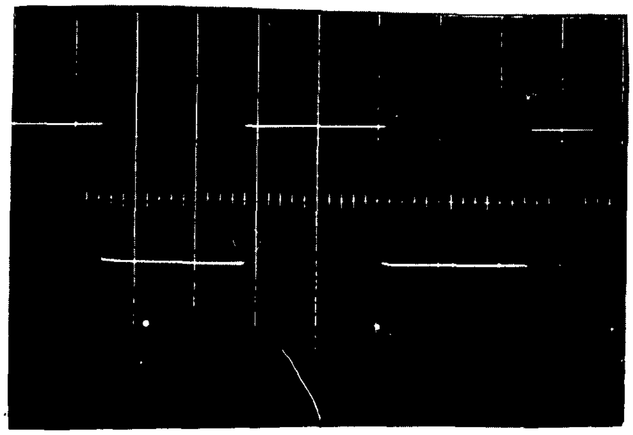
Photo #5 Voltage waveform with TCSS
under maximum load
10X1 attenuator probe used



← max.

Photo #6 Current turn-on transient with
TCSS under maximum load.
Shunt input across [illegible]

TEST 3.1.1.7



A4J3-P

J7-68 (return)

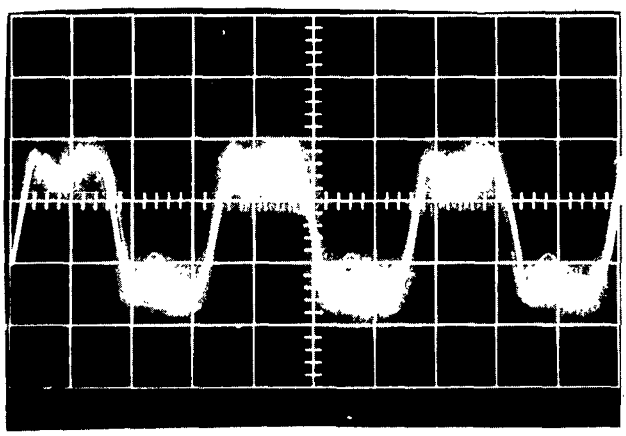
10 volts/cm

0.2 sec/cm

Pos-AC Trigger

Photo #7 TCSS Flasher Output

LF2 through LF11 flashing



20 mv/cm

5 ms/cm

Pos-Ac Trigger

Photo #8 Current waveform across shunt

while LF2-LF11 are flashing

TEST REPORT 3.1.3.1

1. TITLE

LCF System Test, DC Voltage Variation

2. OBJECTIVES

To investigate the effects of varying the +28 volt DC input voltage to the LCF/SCN equipment.

3. CONCLUSIONS

The LCF/SCN equipment will operate properly with a supply voltage of +18.8 volts DC. The SCN equipment will inject, shift, transmit, and retransmit a message properly at this reduced voltage. Status indication lamps on the launch control console illuminate dimly, even though correct status is displayed.

4. EQUIPMENT IN TEST

4.1 Launch Control Console (300) P/N 25-24172-14, S/N 0003

4.2 Communication Control Console (311) P/N 25-27095-5, S/N 0000005

4.3 Cable Termination Equipment (303) P/N 8323562-501, S/N 0000004

4.4 Command Message Processing Group (304) P/N 8323348-502, S/N 0000005

4.5 Status Message Processing Group (305) P/N 8323615-502, S/N 0000004

4.6 LF Launch Equipment

a. Digital Data Group (401) P/N 8323616-505, S/N 0000005

b. Status-Command Message Processing Group (402) P/N 8323617-504, S/N 0000005

c. Programmer Group (403) P/N 25-22036-89, S/N 0000034

d. LF Power Group (406) P/N 25-22552-36, S/N 002

e. G&C Coupler (412) P/N 60950-305, S/N A002B

f. LF Start Up and Missile Simulation Equipment

5. TEST DESCRIPTION

5.1 The equipment was connected per Figure 3.0.0.0-1 (Flagnote #1) and 3.1.3.1-1. The reset button on the Perkins Power Supply was held in the depressed position to disable the sensing of the supply. This prevents the Perkins Supply from kicking out at below normal voltages.

5.2 The input supply voltage was set at approximately +28 volts, and a series of power supply ~~output~~ voltage measurements in the 304 and 305 racks were made.

5.3 The input supply was then lowered as low as possible by adjustment on the Perkins Power Supply. The same monitor points as in (2) above were recorded.

5.4 All possible commands were initiated from the Launch Control Console. These were:

Launch

SCN Test

Test

Calibrate

Inhibit

Target 1

Target 2

5.5 Various command messages were transmitted to the LCF/SCN. These messages were obtained from the message simulator in the NRA Lab. The following messages were sent to the LCF #2:

LCF #5 Launch

LF #2 Test

LF #11 Test

LF #2 Calibrate

LF #5 Calibrate

LF #2 SCN Test

LF #7 SCN Test

LF #2 Target 1

6. SUMMARY OF TEST RESULTS

6.1 At reduced input voltage (+18 VDC) the lamp indications at the Launch Control Console were quite dim.

6.2 The LCF/SCN equipment would successfully inject, shift, transmit, and retransmit at +18 VDC input voltage.

a. Six SCN tests were processed normally with the exception of the dim status indications at the Launch Control Console.

b. Six tests were processed normally with the same dim status lamps at the LCC.

c. Six calibrate commands were properly processed by the LF. The sequence was advanced manually back to Strategic Alert. A dim standby was observed at the LCC.

d. A one vote launch was commanded from the LCF facility, and normal indications were observed at the LCC. The long time timer was verified to be running.

e. An inhibit was commanded, normal indications were observed (Strategic Alert, Armed, Launch in Process).

f. The LCF retransmission was verified by sending various messages on line C_2R_1 and observing the oscilloscope monitoring line C_2X_2. The actual message was not observed bit by bit, but rather the presence of a message was detected.

1. Sent LCF #5 Launch

   Retransmission observed

2. Sent LF #2 Test

   No Retransmission observed

3. Sent LF #11 Test

   No Retransmission observed

4. Sent LF #2 Calibrate

   No Retransmission observed

5. Sent LF #5 Calibrate

   No Retransmission observed

6. Sent LF #2 SCN Test

   SCN Test received lamp illuminated

   No Retransmission observed

7. Sent LF #7 SCN Test

   SCN Test received lamp illuminated

   No Retransmission observed

8. Sent LF #2 Target 1

   No Retransmission observed

9. Sent LF #8 Target 2

   No Retransmission observed

7. General Information

7.1 Test Engineer: Richard Mathias, 2-6519-14

7.2 Date Test Completed: 22 March 1963

7.3 Equipment ER's:

U178445

U178430

U150100

U201537

U201541

U201485

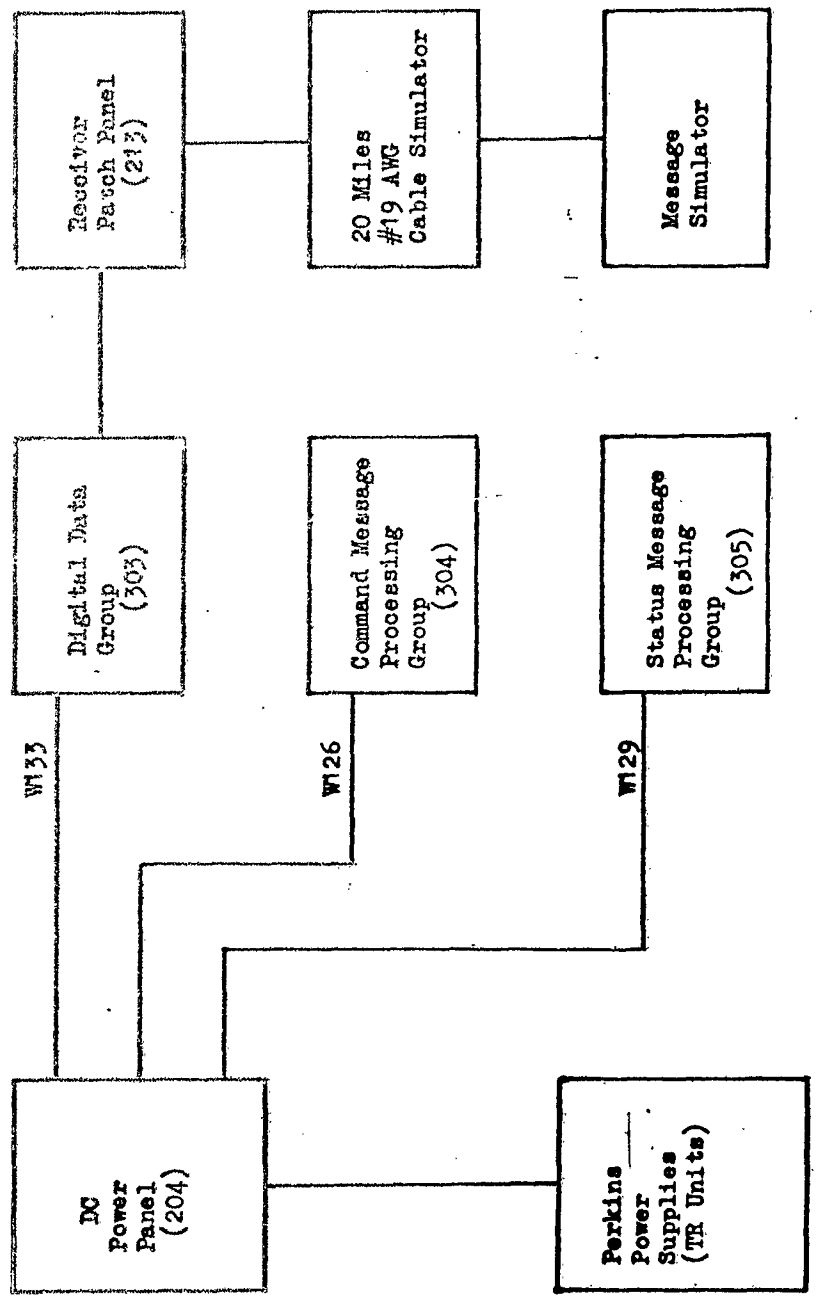


FIGURE 3.1.3.1-1

TEST REPORT 3.2.1.1

1.0 Title

LF Power Supply Group, Load Test and 400 ~ Voltage Variation

2.0 Objectives

2.1 To determine input and output characteristics of the LF Power Supply Group rack.

2.2 To determine the SCN Rack power regulation.

3.0 Conslusions

3.1 Good regulation by the Power Group rack is indicated when lowering the 400 cps input down to 100 volts. Figures 3.2.1.1-2 through 3.2.1.1-9 indicated very irregular loading below 100 volts. Sudden decrease in load is apparent at several different points.

3.2 The input power factor variation with respect to varying 400 ~ voltage was highly irregular (see Figure 3.2.1.1-9); this prompted a rerun of a major portion of the test. The test was set up as before, but the results indicate that the conditions were different. Sudden decreases in load upon the Power Group were not observed at lowered input voltages during the rerun. Data from the rerun are plotted on Figures 3.2.1.1-10 through 3.2.1.1-13.

3.3 Even though the 28 volt input to the LF/SCN started to decrease when the 400 cps voltage was lowered to 85 volts, LF/SCN voltage regulation was maintained down to 400 cps input of 70 volts. Figure 3.2.1.1-8 indicates satisfactory results.

4.0 Equipment in Test

4.1 LF Power Supply Group, Figure A 1284 S/N 0002 P/N 25-22552-36

4.2 LF Status Command Message Processing Group, Figure A 1228 P/N 8323617-504, S/N 0000005

4.3 LF Digital Data Group Figure A 1251, P/N 8323616-505, S/N 0000005

4.4 Programmer Group Figure A 1201, P/N 25-22036-89, S/N 0000034

4.5 Guidance and Control Coupler Figure A 604, P/N 55103-107, S/N AHB0003

4.6 Distribution Box Figure A 1377 P/N 25-23468-38, S/N 0003

4.7 Missile and Launch Simulator Figure A 4490 P/N 25-33940-1, S/N 0003

5.0 Test Description

5.1 Equipment connected per Figures 3.0.0.0-1 and 3.2.1.1-14.

5.2 The 400 ~ input was adjusted to 120 volts with no load.

5.3 At the Power Group rack, turned on A1 and A4 circuit breakers measured the following inputs to the Power Group.

5.3.1 A1 = 0.5 Amp with 9.5 amp overshoot

5.3.2 A2 = 0.5 Amp

5.3.3 A3 = 0.5 Amp

5.3.4 VØA = 120 VAC

5.3.5 W2 = 150 Watts with 350 watts overshoot

5.3.6 W3 = 200 Watts

5.4 At the Power Group rack, turned on A2 and A3 circuit breakers measured input to Power Group.

5.4.1 A1 = 0 Amp with 5.5 Amperes overshoot

5.4.2 A2 = 0 Amp

5.4.3 A3 = 0 Amp

5.4 (cont'd)

5.4.4 VØA = 120 VAC

5.4.5 W2 = 150 Watts with 200 Watts overshoot

5.5 At the Power Group rack, turned on A1, A2, A3, and A4 circuit breakers. Measured input to Power Group.

5.5.1 A1 = 1.5 Amps with overshoot beyond 0-10 Amp meter range

5.5.2 A2 = 1.5 Amps

5.5.3 A3 = 1.5 Amps

5.5.4 W2 = 250 Watts

5.5.5 W3 = 300 Watts

5.5.6 VØA = 120 VAC

5.5.7 Frequency = 412 cps

5.6 Photographed voltage and current in ØA, used 10X1 attenuator probe for the voltage.

5.7 Depressed P/G, Coupler, 400~ Monitor and Security Circuit breakers on the LF Power Group. Measured the input to the Power Group.

5.7.1 A1 = 3 Amps

5.7.2 A2 = 2.95 Amps

5.7.3 A3 = 2.85 Amps

5.7.4 W2 = 500 Watts

5.7.5 W3 = 500 Watts

5.7.6 VØA = 120 VAC

5.8 Photographed 400~ voltage and current input

5.9 Depressed both G&C electronics circuit breakers at the LF Power Supply Group. Measured the input to the LF Power Supply Group rack.

5.9.1 A1 = 7.05 Amps

5.9.2 A2 = 6.95 Amps

5.9.3 A3 = 6.97 Amps

5.9.4 VØA = 120 VAC

5.9.5 W2 = 1.1 KW

5.9.6 W2 = 1.27 KW

5.10 Photographed 400 ~ voltage and current

5.11 Depressed SCN Circuit breakers and turned on SCN racks. Measured input to LF Power Supply Group

5.11.1 A1 = 9.3 Amps

5.11.2 A2 = 9.1 Amps

5.11.3 A3 = 9.1 Amps

5.11.4 VØA = 120 VAC

5.11.5 W2 = 1.36 KW

5.11.6 W3 = 1.6 KW

5.11.7 F = 417

5.12 Measured Power Supply Group output at Breakout Box. See Table 3.2.1.1-1, tabulation of results at 400 ~ input of 120 V.

5.12.1 A4 is the 3.5 Ω load with a 10 Amp 50 mv shunt.

5.12.2 A5 is the 1 Ω load with a 50 Amp 50 mv shunt.

5.12.3 A6 is the 402 rack with a 10 Amp 50 mv shunt.

5.12.4 A7 is the 401 rack with a 10 Amp 50 mv shunt.

5.13 Photographed voltage and current ripple

5.14 Measured rack 402 power regulator outputs. See Table 3.2.1.1-1. +28 VDC is measured across J2-A and B, +6 VDC is measured across J2- H and G, -6 VDC is measured across J2-C and G, -9 VDC is measured across J2-J and G and -18 VDC is measured across J2-E and G.

5.15 Steps 5.11 through 5.14 were repeated with the 400 ∿ input decreased to 115 V, 110 V, 105 V, 100 V, 95 V, 90 V, 85 V, 80 V, 75 V, 70 V, 65 V, 60 V, and 55 V.

5.16 Photographs were taken of the P/G clock voltages at the Programmer Group A7J1-10 and A7J1-6 referenced to signal common at A7J1-11 for each input voltage change.

5.17 VRSA was interrogated for input voltage change.

5.17.1 At 75 V, VRSA reported channels #7 and 34.

5.17.2 At 70 Volts and 65 Volts, VRSA reported channels 2, 7, and 34.

5.17.3 At 60 Volts and 55 Volts, VRSA reported channels 2, 7, 28, 29, 30, 31, and 34.

5.18 Since the power factor data appeared to be unrealistic, (see Figure 3.2.1.1-9), the 400 ∿ voltage variation portion of the test was re-performed. The data is tabulated on Tables 3.2.1.1-3 and 3.2.1.1-4.

6. Summary of Test Results

6.1 The input versus output characteristics of the LF Power Supply Group is tabulated per Table 3.2.1.1-1. Explanation of the Table is as follows:

A1 = 400 ØA current

A2 = 400 ØB current

6.1 (cont'd)

A3 = 400 ØC current

W2 = ØB referenced to ØA Power

W3 = ØC referenced to ØA Power

V4 = Voltage to 3.5 load at J1-19 and 18.

V5 = Voltage to 1 load at J1-20 and 17.

V6 = Voltage at J2 connector for rack 401

V7 = Voltage at J3 connector for rack 402

A4 = 3.5 load current (mv across 10 amp 50 mv shunt)

A5 = 1 load current (mv across 50 amp 50 mv shunt)

A6 = Figure A 1251 (rack 401) (mv across 10 amp 50 mv shunt)

A7 = Figure A 1228 (rack 402) (mv across 10 amp 50 mv shunt)

6.2 Table 3.2.1.1-1 also tabulates input and output voltages of the Power Regulator drawer of rack 402.

6.3 Total power (KVA), and power factor were calculated for the power measurements of paragraphs 5.3 through 5.11 and are tabulated on Table 3.2.1.1-2.

6.4 Table 3.2.1.1-3 is a tabulation of the results from the test rerun performed on 20 June 1963. The data is plotted on Figures 3.2.1.1-10 through 3.2.1.1-13.

6.5 Table 3.2.1.1-4 tabulates the power data obtained from depressing circuit breakers on the LF Power Group. In some cases, the data appear erroneous, this is due to inadequate recording instruments. Example a 0 to 10 kilowatt meter was used for readings up to only 1.7 KW; A 0 to 2 KW meter was preferable, but this item was unobtainable.

7. General Information

7.1 Test Engineer: Richard Mathias, 2-6519-14

7.2 Data Completed: June 20, 1963

7.3 Applicable ER'S:

7.3.1 Power Supply Group, Figure A 1284

E386147, E491078, E491033, E491041, 4201037, 4042693, R15090, U039184

7.3.2 SCMPG, Figure A 1228:

U201477, U201097, E443967, U150099, U048656, A44111, U147476, U U147526

7.3.3 LF/DDG, Figure A 1251:

E443966, U039176, U039183, U150095, U150046, U147433, U147439, U147524, U147525, U147540, U147562, U147567, A44140, U147570, U187410, A44142, U187512, U147572

7.3.4 Programmer Group, Figure A 1201:

U150050, U150056, U150062, R29761, U178447, R157519

7.3.5 G&C Coupler, Wing II, Figure A 604:

No open ER's

7.3.6 LF Distribution Box, Figure A 1377

U147471, U147472, U147548, U147465, U147521

7.3.7 Missile and Launch Simulator, Figure A 4490:

U147534, U147457, U147459, A44135

400~ Input	Current (amps)			Power (kw)		Voltage (volts DC)				Current (mv across shunt)				Rack 402 Volts DC				
	A_1	A_2	A_3	W_2	W_3	V_4	V_5	V_6	V_7	A_4	A_5	A_6	A_7	+28	+6	-6	-9	-18
120 V	9.3	9.1	9.1	1.36	1.6	27.25	26.79	27.88	27.88	38	26	47	51	26.90	6.00	6.11	8.96	17.89
115 V	9.3	9.15	9.2	1.36	1.6	27.37	26.80	27.88	27.88	38	26	48	51	26.89	6.00	6.11	8.96	17.89
110 V	9.2	9.25	9.3	1.39	1.6	27.37	26.86	27.89	27.87	38	26	48	51	26.91	6.00	6.11	8.96	17.90
105 V	8.95	8.75	9.2	1.36	1.2	27.42	26.79	27.89	27.89	38	26	48	51	26.91	6.00	6.12	8.96	17.90
100 V	8.55	8.8	9.45	1.34	1.2	27.39	26.79	27.75	27.80	38	26	48	51	26.90	6.00	6.11	8.96	17.90
95 V	8.8	8.45	9.0	1.2	1.1	26.23	26.68	27.25	27.31	37	26	47	51	26.90	6.00	6.11	8.96	17.90
90 V	8.8	7.9	8.4	1.03	0.9	23.9	24.28	24.73	24.79	34	24	45	51	26.89	6.00	6.11	8.96	17.89
85 V	7.7	7.25	7.6	0.84	.65	21.58	21.94	22.31	22.17	30	22	43	48	25.02	5.97	6.09	8.94	17.82
80 V	6.9	6.8	7.15	.76	.62	19.92	20.26	20.57	20.61	28	20	40	45	23.22	5.95	6.06	8.91	17.75
75 V	6.5	6.35	6.75	.66	.55	18.70	19.03	19.31	19.34	27	19	38	42	21.60	5.92	6.03	8.89	17.59
70 V	6.35	6.1	6.7	.67	.58	19.35	19.69	20.42	20.28	28	20	16	43	19.46	5.87	5.97	8.85	16.35
65 V	6.32	6.18	6.55	.64	.55	18.54	18.20	18.93	18.97	26	18.5	14.7	41	17.98	5.80	5.67	8.81	15.17
60 V	5.44	5.30	5.60	.55	.40	17.28	16.93	17.99	17.93	24.1	17.2	13.5	38.6	18.17	.21	+.23	4.40	+.22
55 V	4.00	4.00	4.18	.36	.30	15.47	15.14	16.52	16.55	21.8	15.5	12.0	1.1	16.48			3.92	

TABLE 3.2.1.1-1

Tabulation of Calculated
Data from Table 3.2.1.1-1

400 cps Input Volts RMS	I Ave. Amps RMS	Wt (W2 + W3)	Power Factor	Total Pwr. KVA
120 V	9.17	2.96 KW	0.90	3.3
115	9.22	2.96	0.93	3.18
110	9.25	2.99	0.98	3.05
105	8.97	2.56	0.91	2.83
100	8.93	2.56	.96	2.58
95	8.75	2.30	.92	2.49
90	8.37	1.93	.85	2.26
85	7.52	1.49	.76	1.95
80	6.95	1.38	.83	1.665
75	6.53	1.21	.82	1.467
70	6.38	1.25	.93	1.34
65	6.34	1.19	.96	1.233
60	5.45	.95	.97	0.98
55	4.06	.66	.96	.668

Total Real Power = (P) = $W_2 + W_3$

Reactive Power (Px) = $\sqrt{3}\,(W_2 - W_3)$

Total Volt-Ampers (VA = $\sqrt{P^2 + Px^2}$

Power Factor = $\frac{P}{VA}$

TABLE 3.2.1.1-2

TABLE

Tabulation of data rerun performed on 20 June 1963.
Data is plotted on Figures 3.2.1.1-10 through 3.2.1.1-13

400 cps input Volts RMS	A_1 Amps RMS	A_2 Amps RMS	A_3 Amps RMS	A Ave. Amps RMS	W2 Kilowatts	W3 Kilowatts	Wt (W2 + W3)	Total Pwr. KVA	Power Factor
120	9.2	9.4	9.15	9.25	1.45	1.7	3.15	3.33	.945
115	9.5	8.8	9.2	9.17	1.33	1.6	2.93	3.16	.928
110	9.1	9.1	9.1	9.10	1.34	1.5	2.84	3.0	.946
105	9.1	9.0	9.1	9.07	1.28	1.47	2.75	2.86	.96
100	9.0	8.85	9.05	8.98	1.2	1.4	2.6	2.7	.962
95	9.3	8.6	8.8	8.9	1.06	1.3	2.36	2.54	.93
90	9.1	8.3	8.7	8.7	.96	1.2	2.16	2.35	.92
85	8.7	8.0	8.4	8.37	.88	1.1	1.98	2.13	.93
80	8.3	7.7	7.85	7.95	.80	1.0	1.8	1.91	.942
75	7.75	7.35	7.35	7.48	.72	.85	1.57	1.68	.945
70	7.3	6.8	7.0	7.03	.63	.75	1.38	1.48	.932
65	6.7	6.3	6.45	6.48	.54	.6	1.14	1.26	.905
60	6.15	5.65	5.65	5.90	.45	.5	.95	1.06	.896
55	4.1	3.9	3.85	3.95	.3	.3	.60	0.65	.923

TABLE 3.2.1.1-3

Para.	Condition	A1	A2	A3	Vθ	W2	W3	Real Power	Total Power	Power Factor
5.3	Depress A1 and A4	0.5a	0.5a	0.5a	120 V	150 W	200 W	350	180 VA	△1
5.4	Depress A2 and A3	0	0	0	120 V	150 W		150	0 VA	△1
5.5	Depress A1A2, A3, A4	1.5a	1.5a	1.5a	120 V	250 W	300 W	550	540 VA	△1
5.7	Depress P/G, Coupler 400~ Monitor & SS	3a	2.95a	2.85a	120 V	500 W	500 W	1000	1.05KVA	0.95
5.9	Depress both G&C Electronics CB's	7.05	6.95	6.97	120 V	1.1KW	1.27KW	2.37KW	2.52KVA	0.94
5.11	Depress SCN CB's and Turn SCN ON	9.3	9.1	9.1	120 V	1.36KW	1.6KW	2.96KW	3.3KVA	0.90
5.3	Repeat on 6-20-63	1.0	0.8	0.8	120 V	150 W	50 W	200	313 VA	0.64
5.4	Repeat on 6-20-63	.05	.05	.05	120 V	120 W	50 W	170	18 VA	?
5.5	Repeat on 6-20-63	1.75	1.65	1.6	120 V	120 W	250 W	550	594 VA	0.93

△1 See par. 6.5

TABLE 3.2.1.1-4

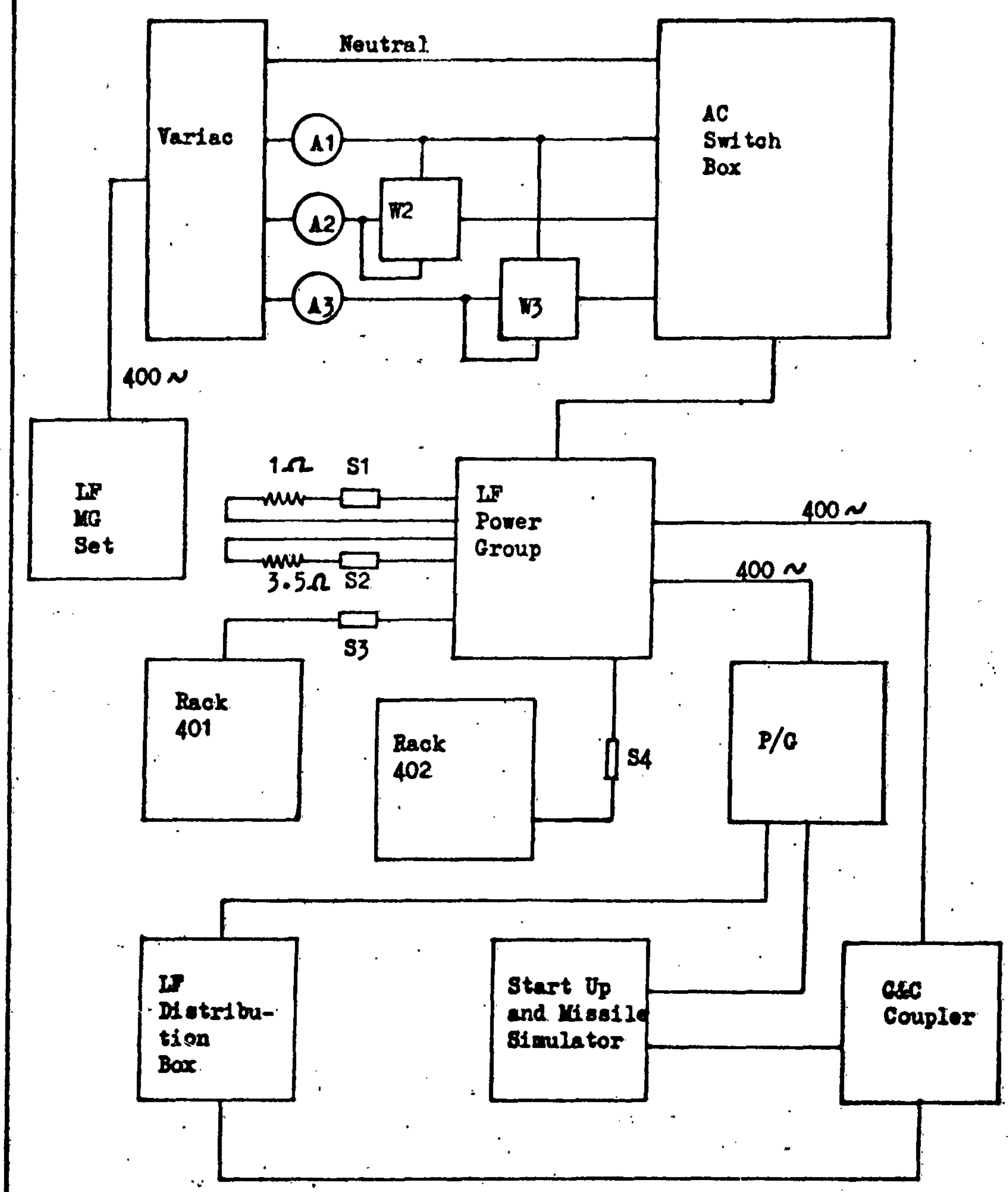


FIGURE 3.2.1.1-1

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2-8142-2

REV SYM B

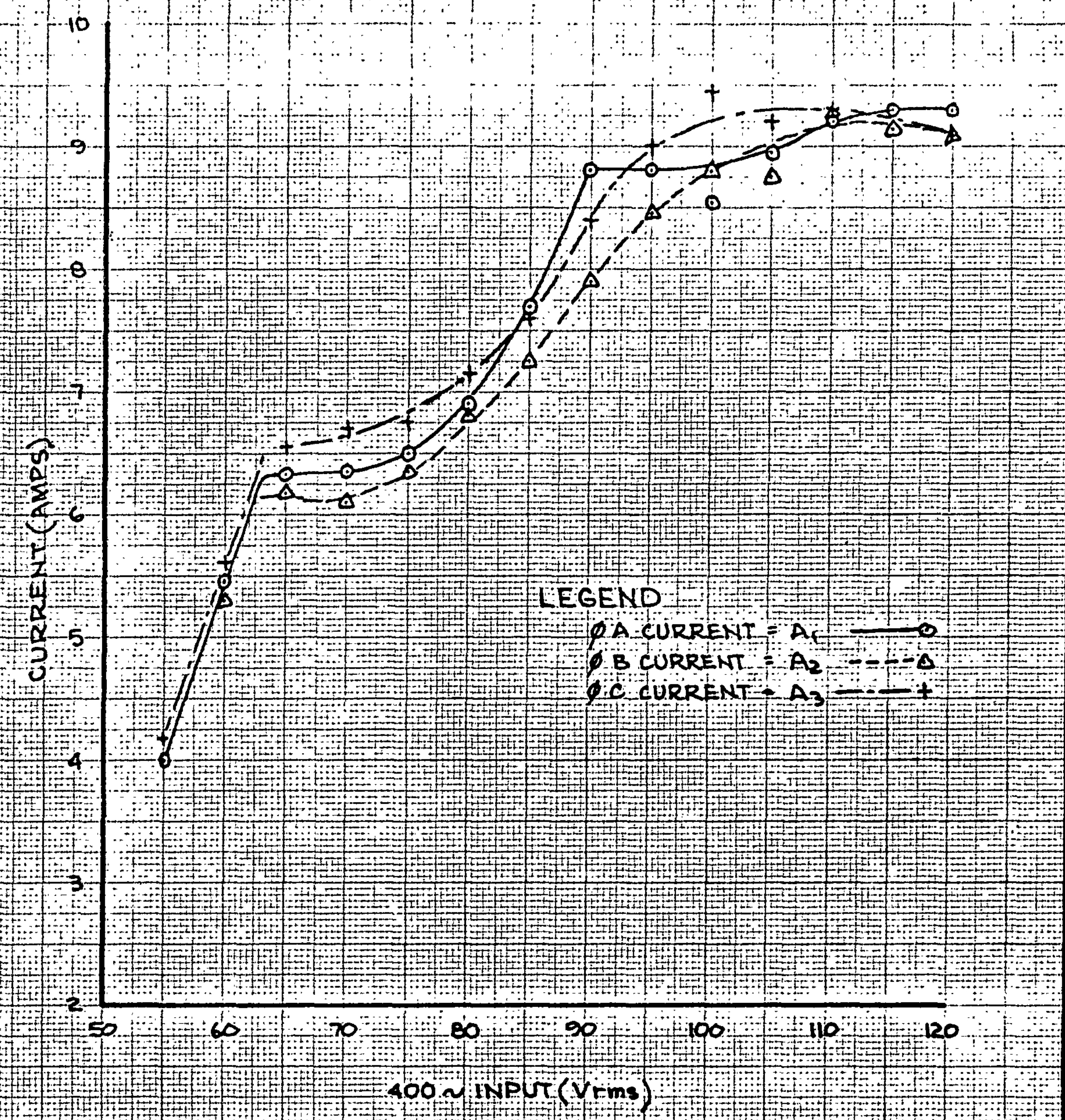

FIGURE 3.2.1.1-2

CALC			REVISED	DATE	INPUT AC CURRENT TO POWER GROUP RACK	T2-2555 Vol. III
CHECK						Sec. D
APR					THE BOEING COMPANY	PAGE 109
APR						

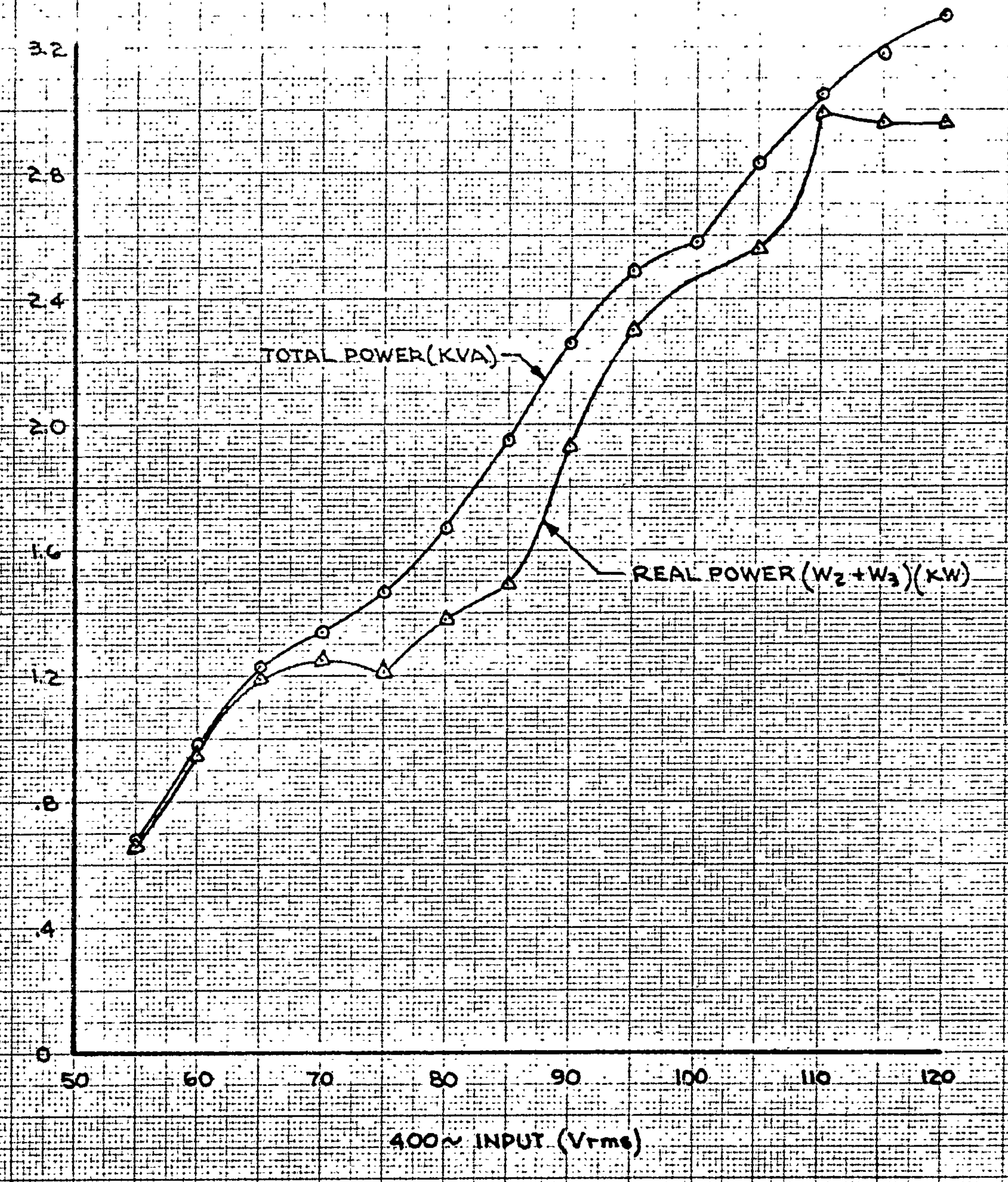

FIGURE 3.2.1.1-3

CALC			REVISED	DATE	POWER INPUT TO LF POWER SUPPLY GROUP, FIG A 1284	T2-2555 Vol. III Sec. D
CHECK						
APR						
APR					THE BOEING COMPANY	PAGE 110

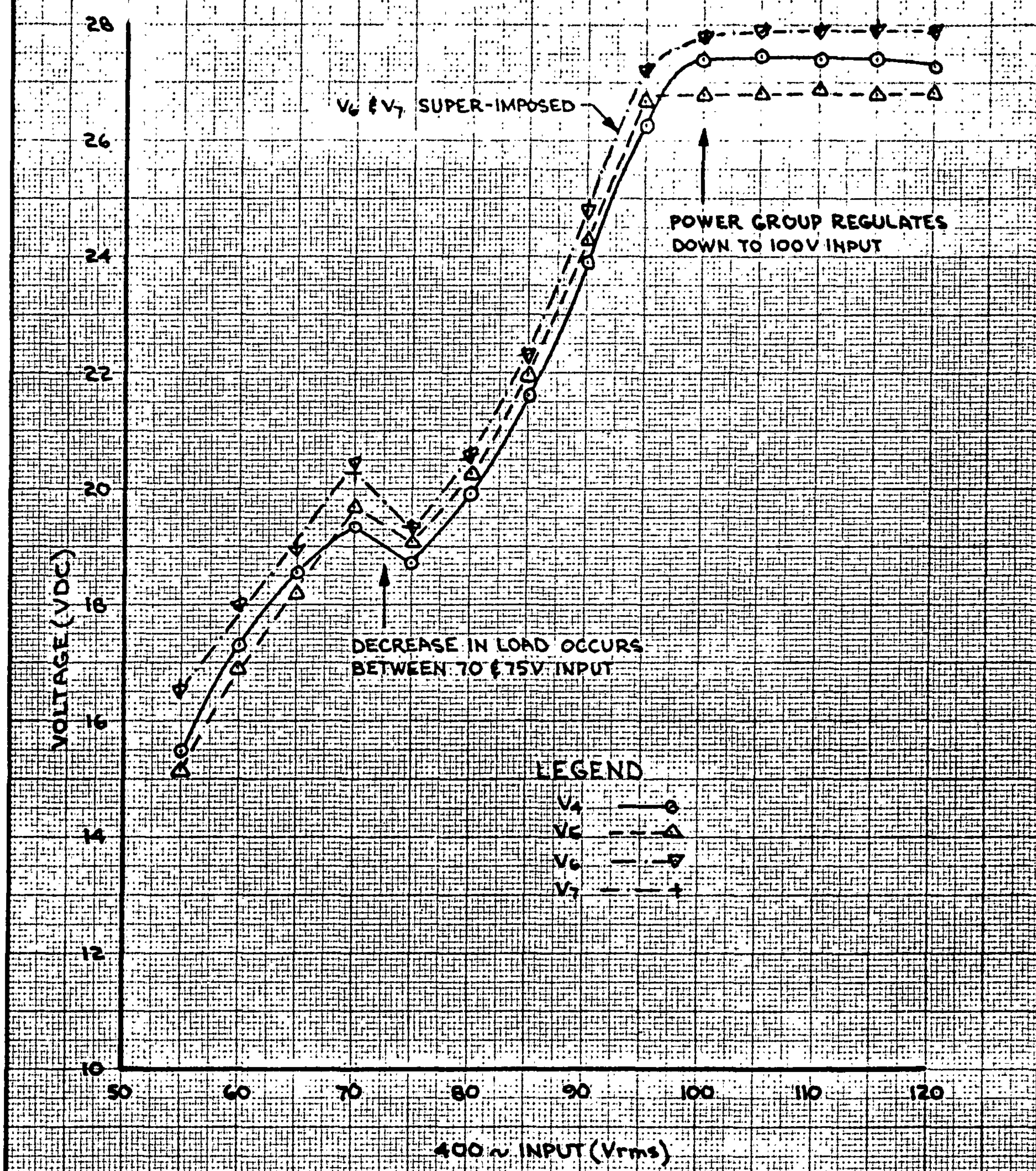

FIGURE 3.2.1.1-4

CALC			REVISED	DATE	POWER GROUP 28 VDC OUTPUTS	T2-2555 Vol III
CHECK						Sec. D
APR					THE BOEING COMPANY	PAGE 111
APR						

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K+E ALBANENE 196L TRACING PAPER 68587

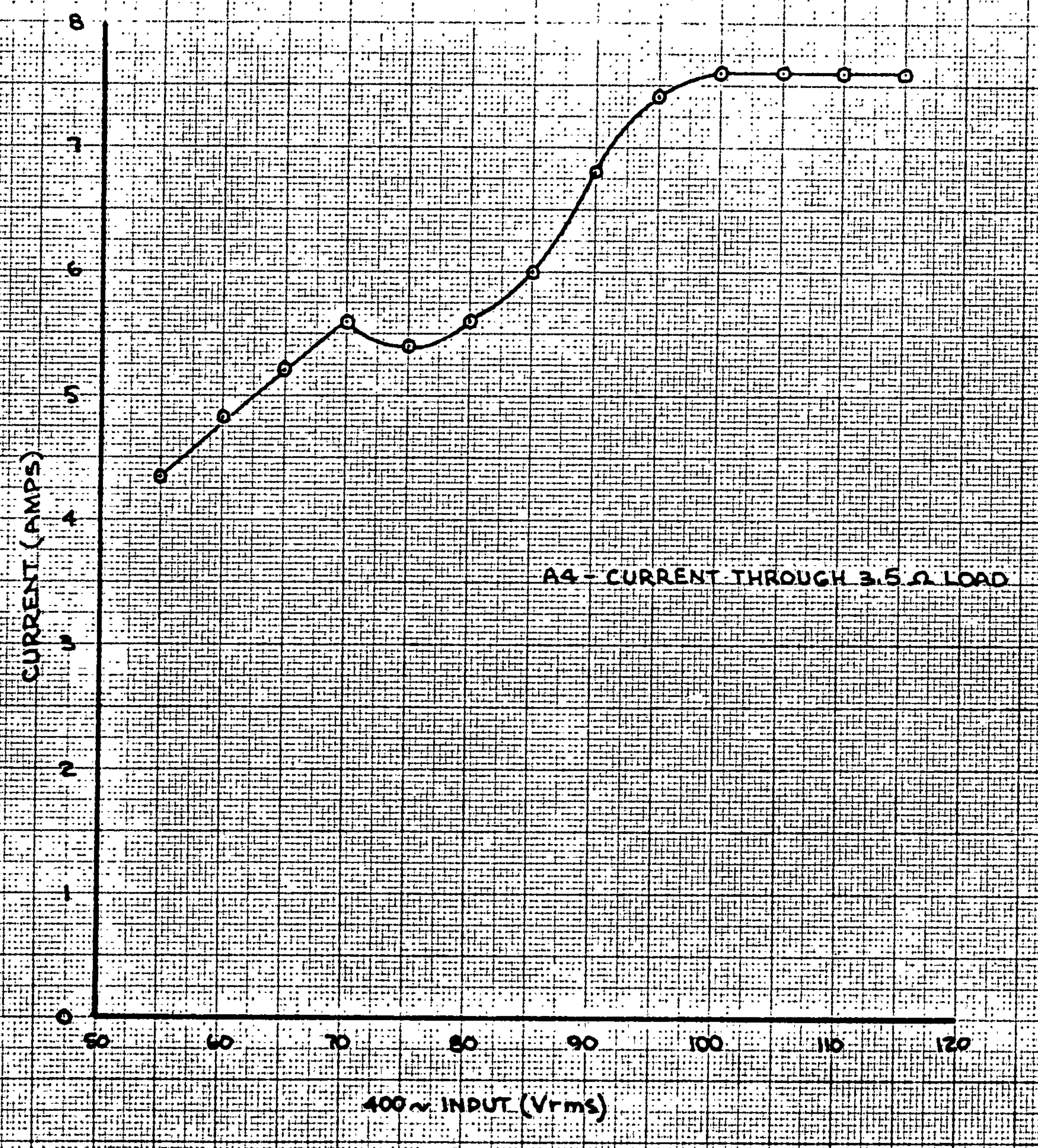

FIGURE 3.2.1.1-5

CALC			REVISED	DATE	CURRENT THROUGH 3.5 Ω LOAD SIMULATED G & C LOAD	T2-2555 Vol. III Sec. D
CHECK						
APR						
APR					THE BOEING COMPANY	PAGE 112

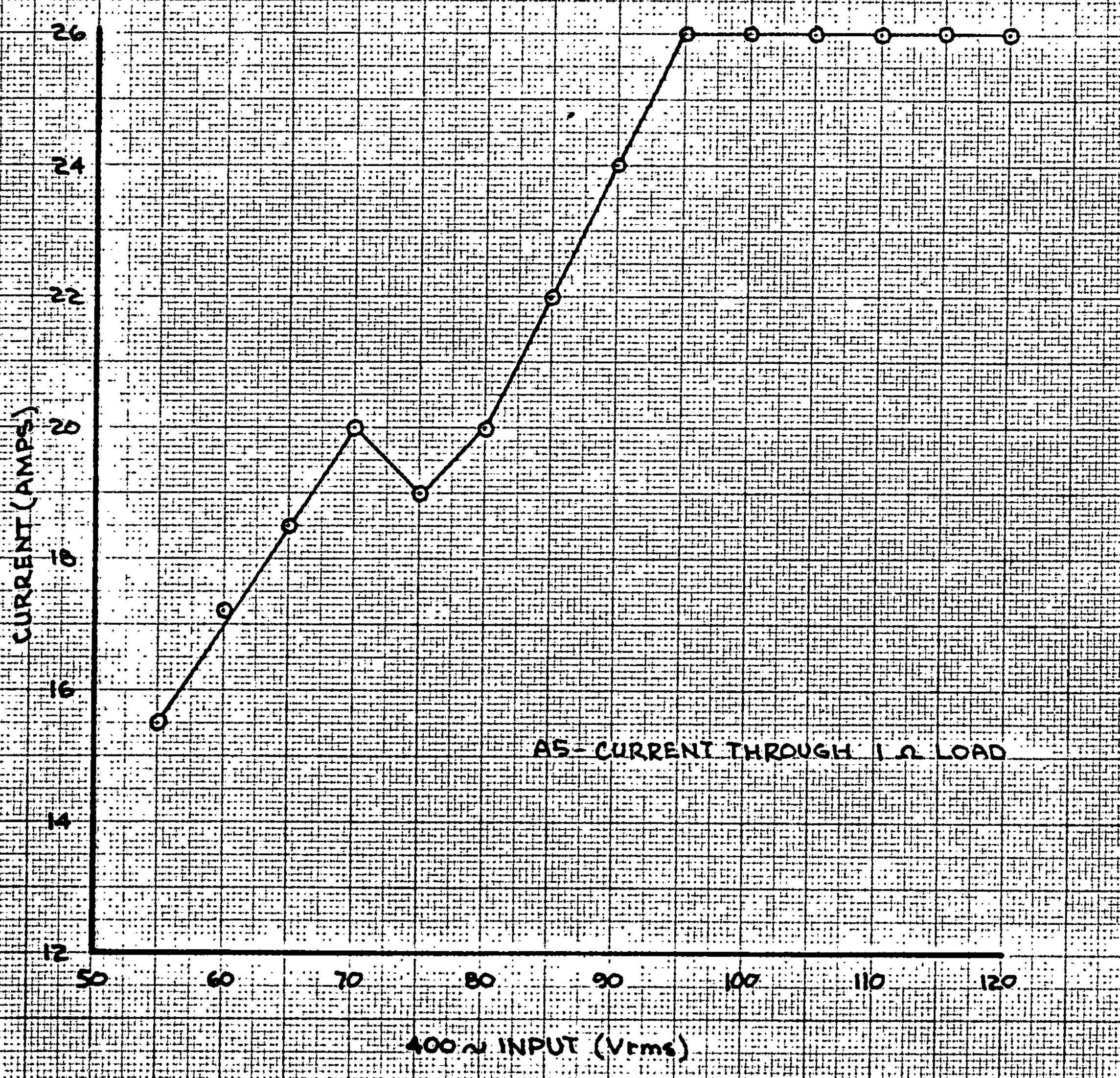

FIGURE 3.2.1.1-6

CALC			REVISED	DATE	CURRENT THROUGH 1Ω LOAD SIMULATED G & C LOAD	T2-2555 Vol. III
CHECK						Sec. D
APR					THE BOEING COMPANY	PAGE 113
APR						

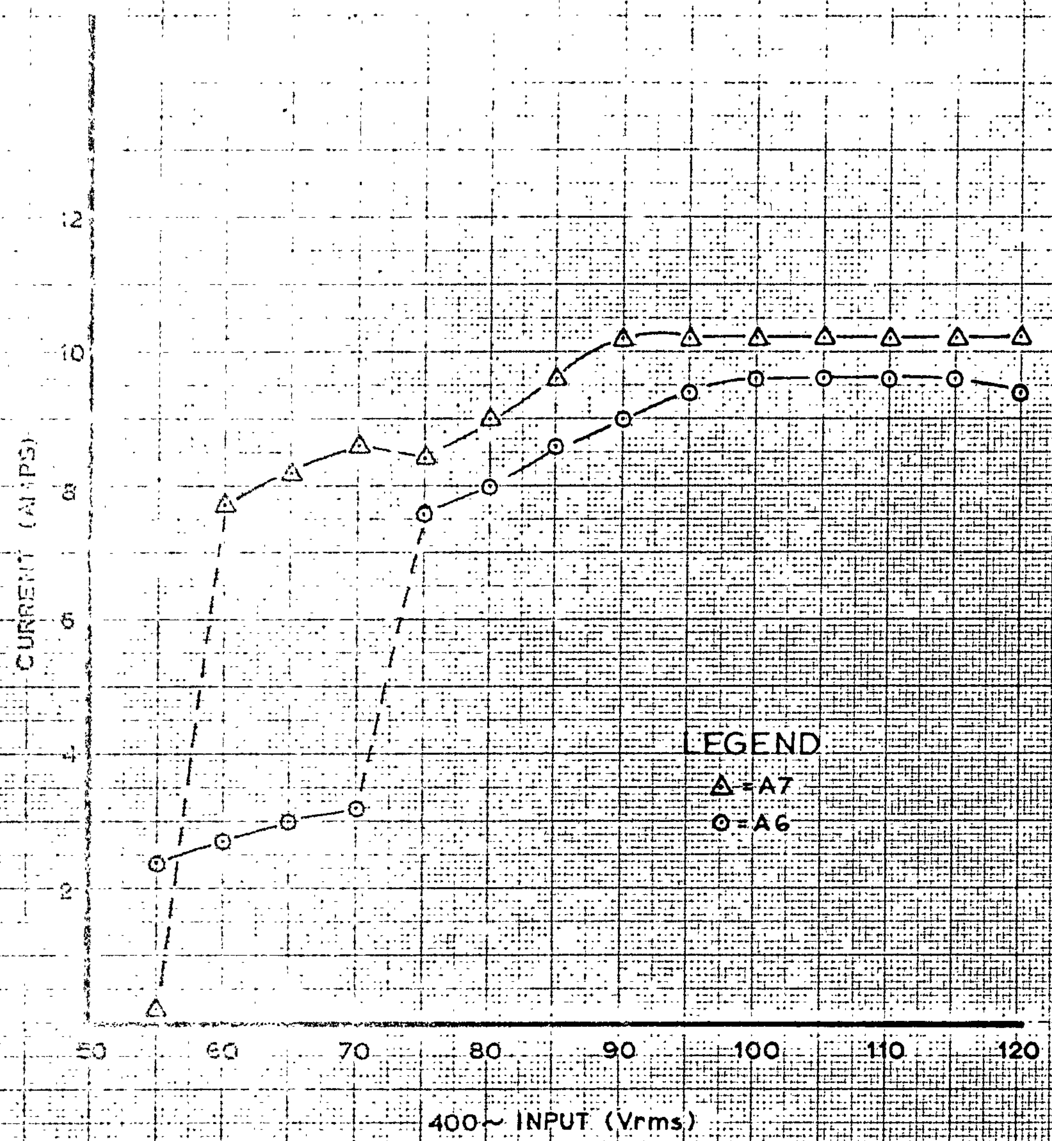

FIGURE 3.2.1.1-7

CALC			REVISED	DATE	LF/SCN 28VAC INPUT	T2-2555 Vol III Sec. D
CHECK						
APR						
APR					THE BOEING COMPANY	PAGE 114

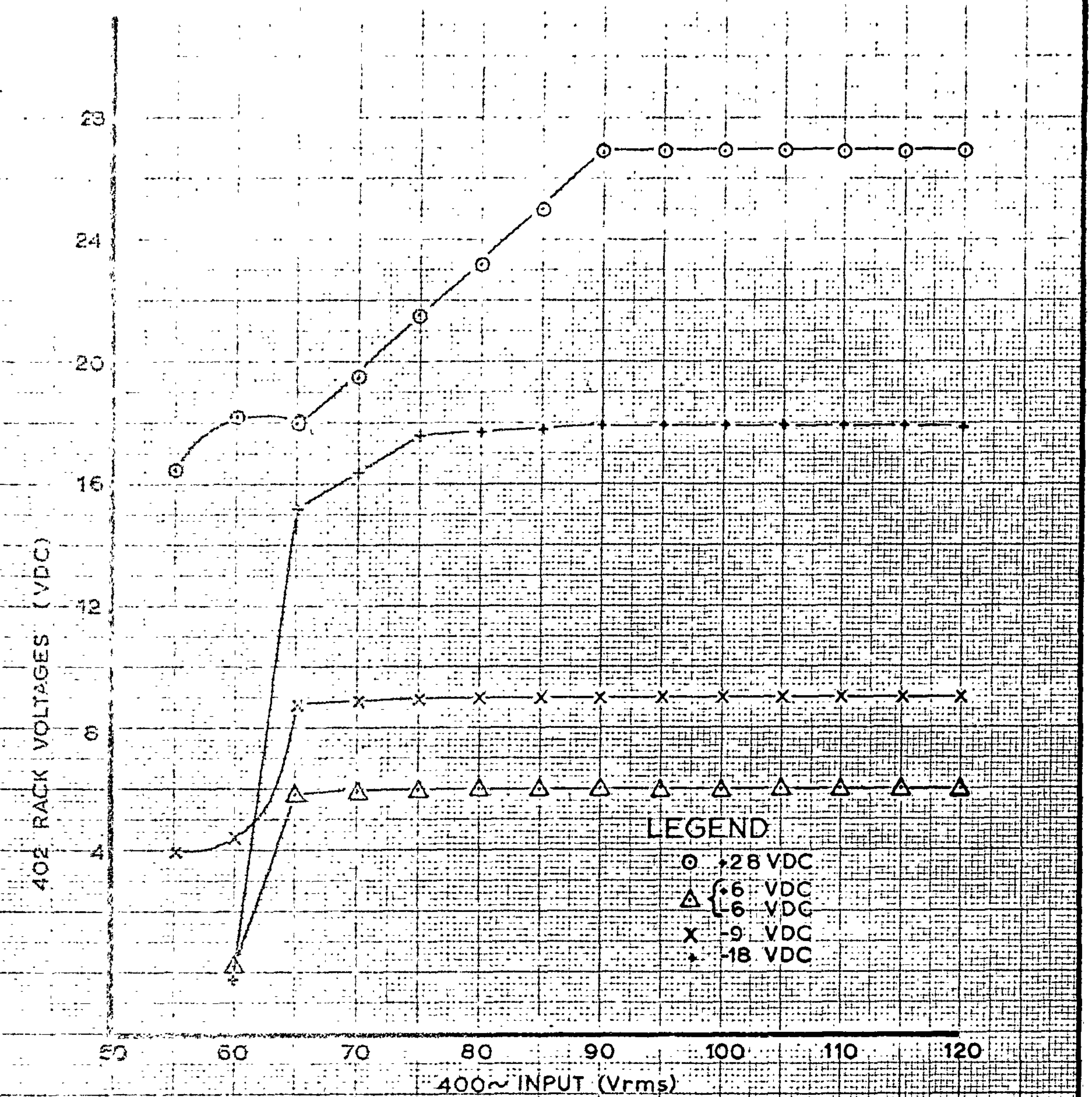

FIGURE 3.2.1.1-8

CALC			REVISED	DATE	SCNPG RACK SUPPLY VOLTAGE	T2-2555 Vol. III
CHECK						Sec. D
APR					THE BOEING COMPANY	PAGE 115
APR						

U3 4013 cc-0 REV R

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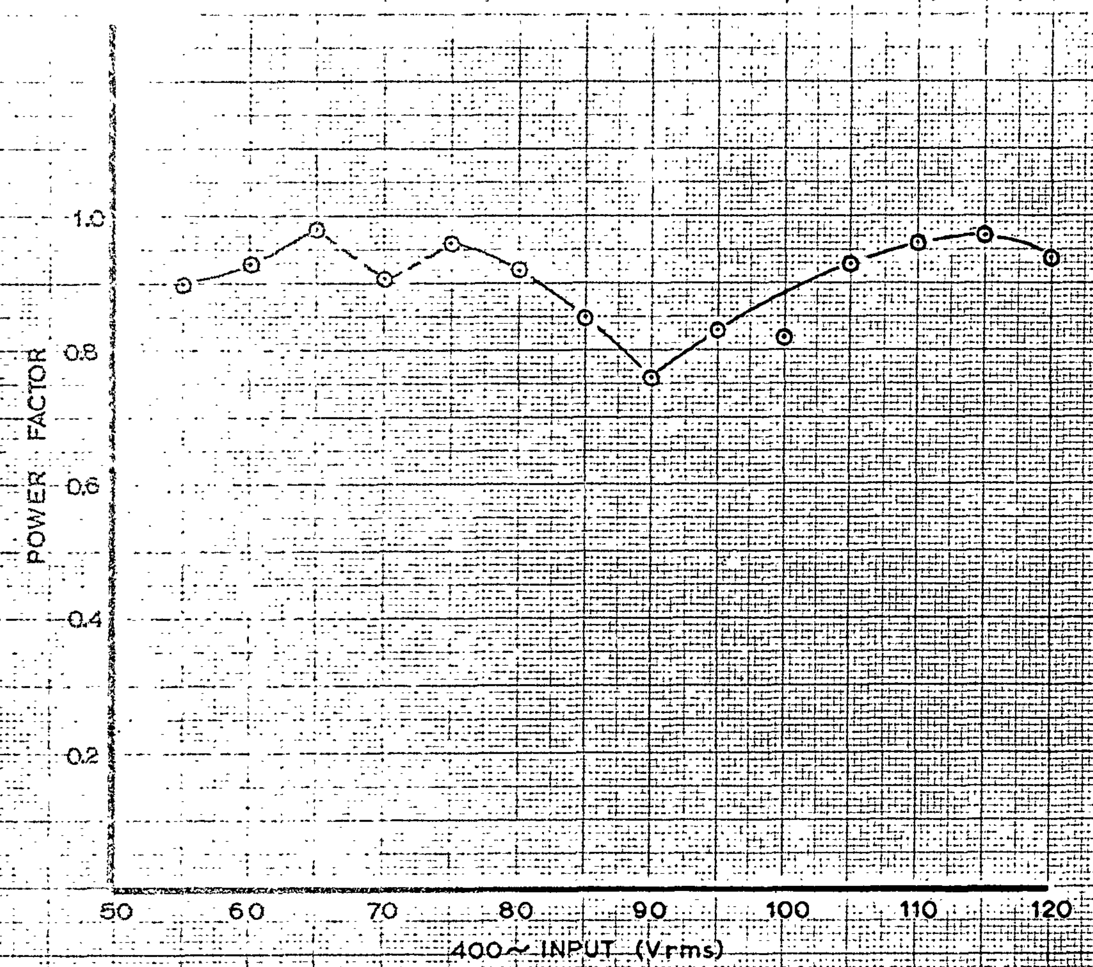

FIGURE 3.2.1.1-9

CALC			REVISED	DATE	POWER FACTOR VARIATION	T2-2555 Vol. III
CHECK						Sec. D
APR					THE BOEING COMPANY	PAGE 116
APR						

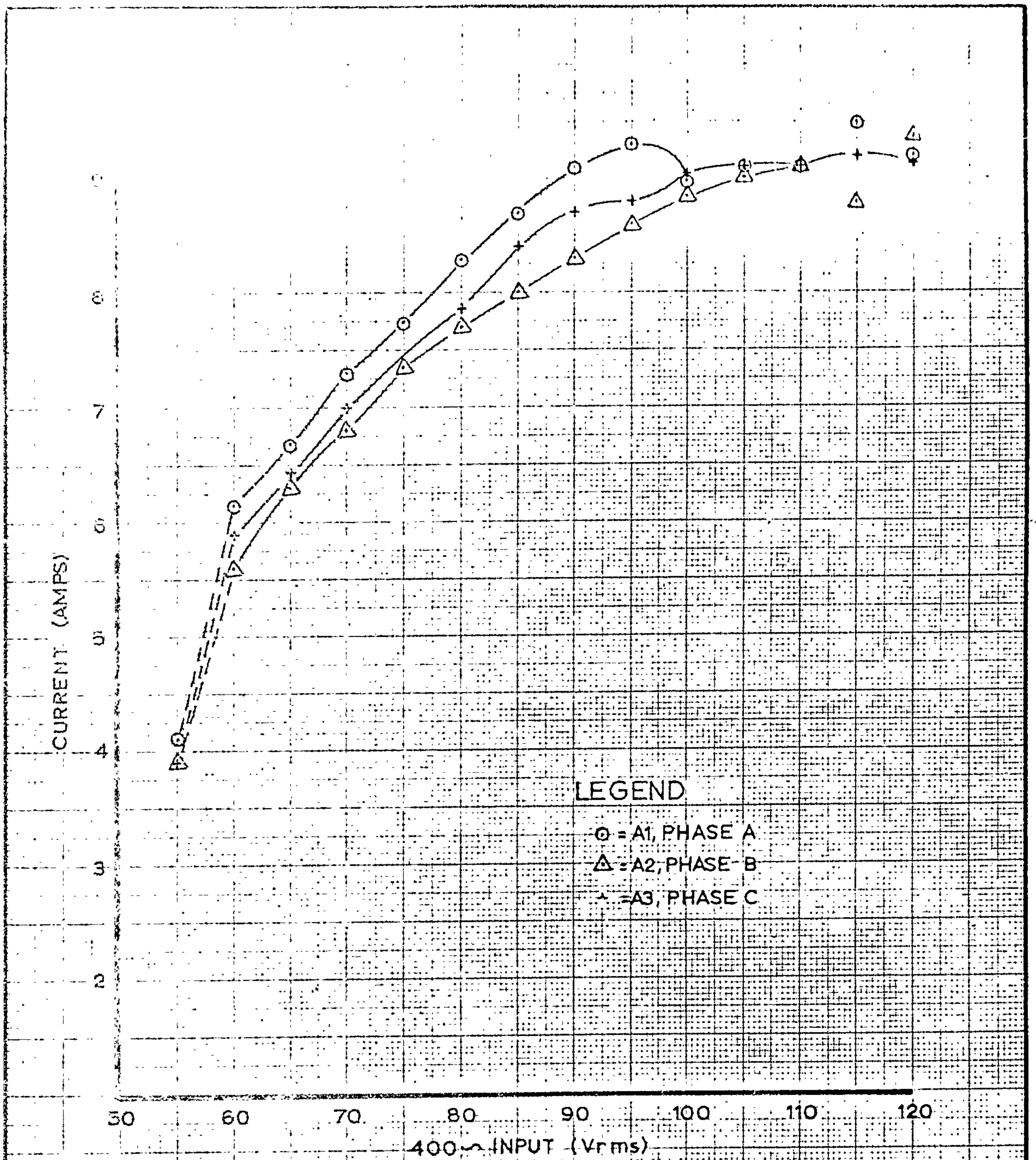

FIGURE 3.2.1.1-10

CALC			REVISED	DATE	DATA OF TEST RERUN 6/20/63 INPUT PHASE CURRENT	T2-2555 Vol. III Sec. D
CHECK						
APR						
APR					THE BOEING COMPANY	PAGE 117

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K+E ALBANENE 195L TRACING PAPER 68587

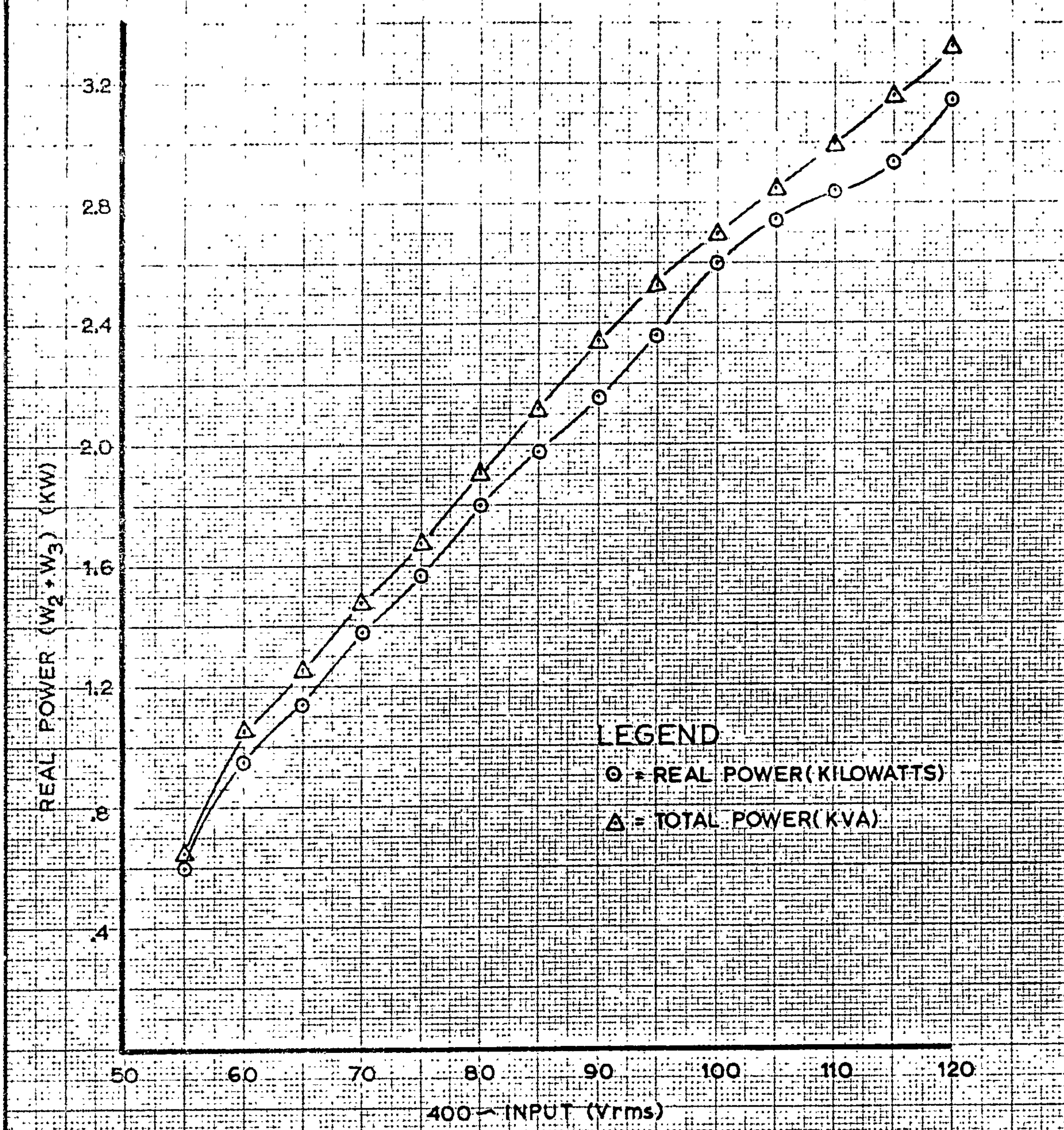

FIGURE 3.2.1.1-11

CALC			REVISED	DATE	DATA OF TEST RERUN 6/20/63 TOTAL & REAL POWER	T2-2555 Vol. III Sec. D
CHECK						
APR					THE BOEING COMPANY	PAGE 118
APR						

U3 4013 6000 REV R

K·E ALBANENE 195L TRACING PAPER 68587

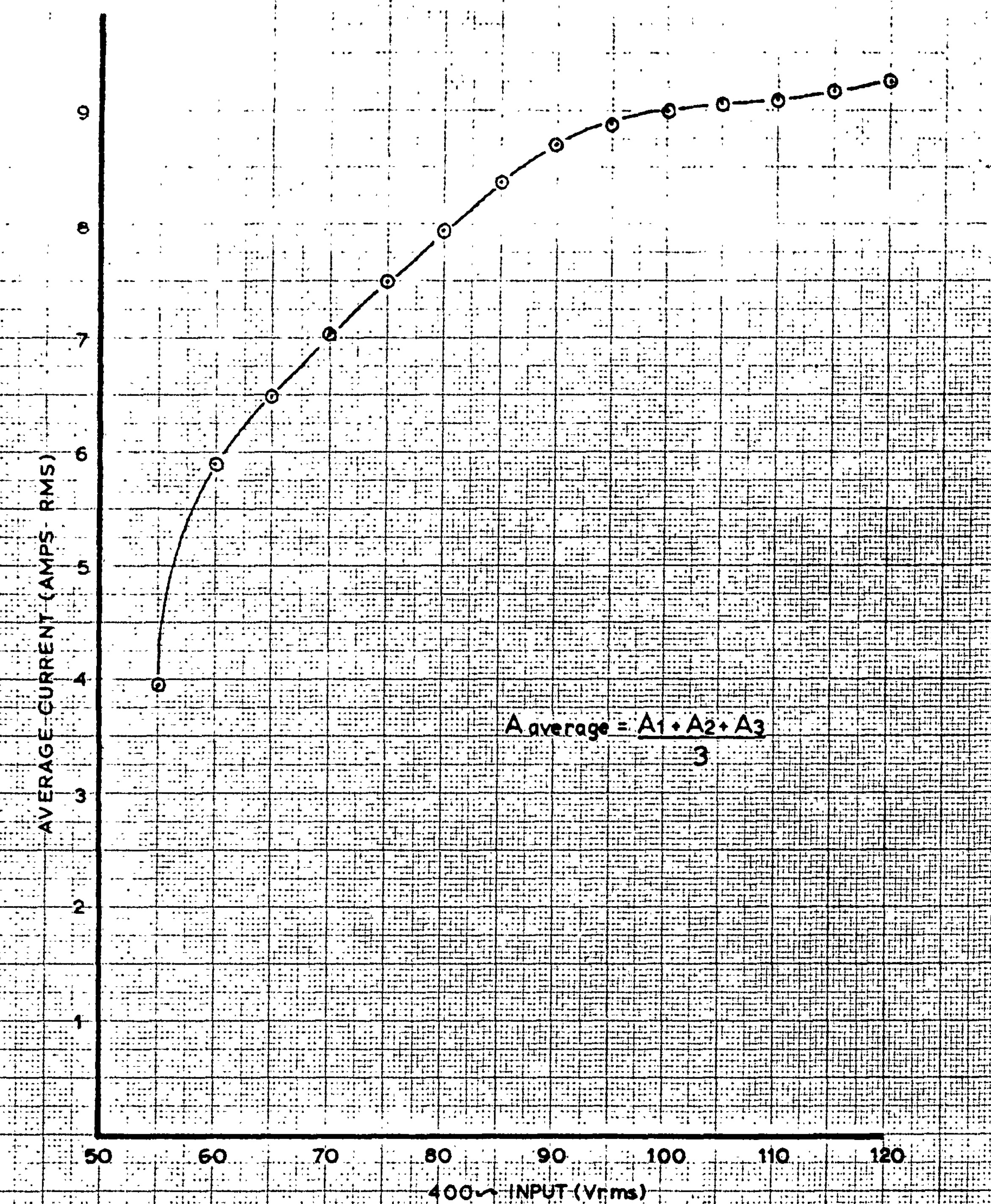

FIGURE 3.2.1.1-12

			REVISED	DATE		
CALC					AVERAGE INPUT PHASE CURRENT DATA OF TEST RERUN 6/20/63	T2-2555 Vol. III
CHECK						Sec. D
APR					THE BOEING COMPANY	PAGE 119
APR						

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K+E ALBANENE 196L TRACING PAPER 68587

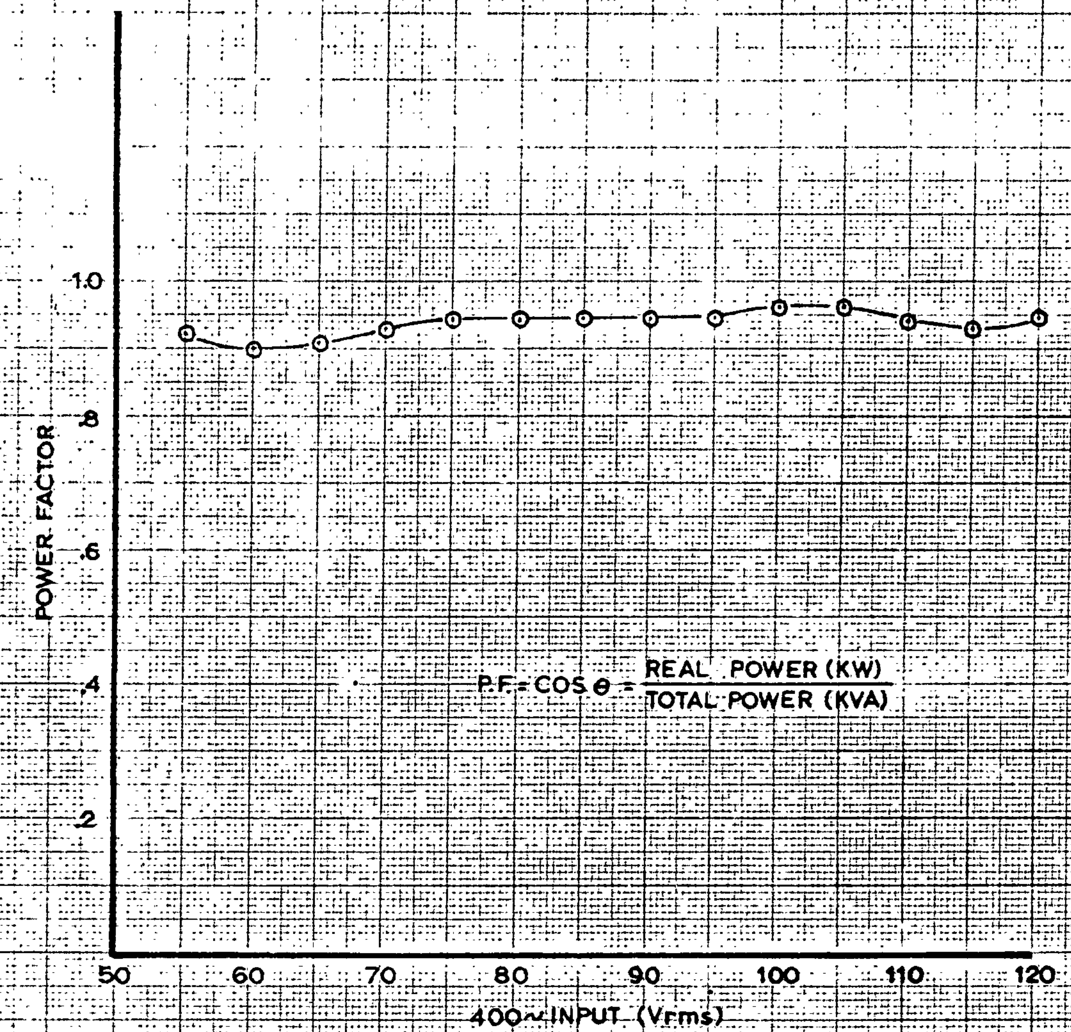

FIGURE 3.2.1.1-13

			REVISED	DATE		
CALC					POWER FACTOR VARIATION DATA OF TEST RERUN 6/20/63	T2-2555 Vol. III Sec. D
CHECK						
APR						
APR					THE BOEING COMPANY	PAGE 120

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H-E ALBANENE 1000 TRACING PAPER 68587

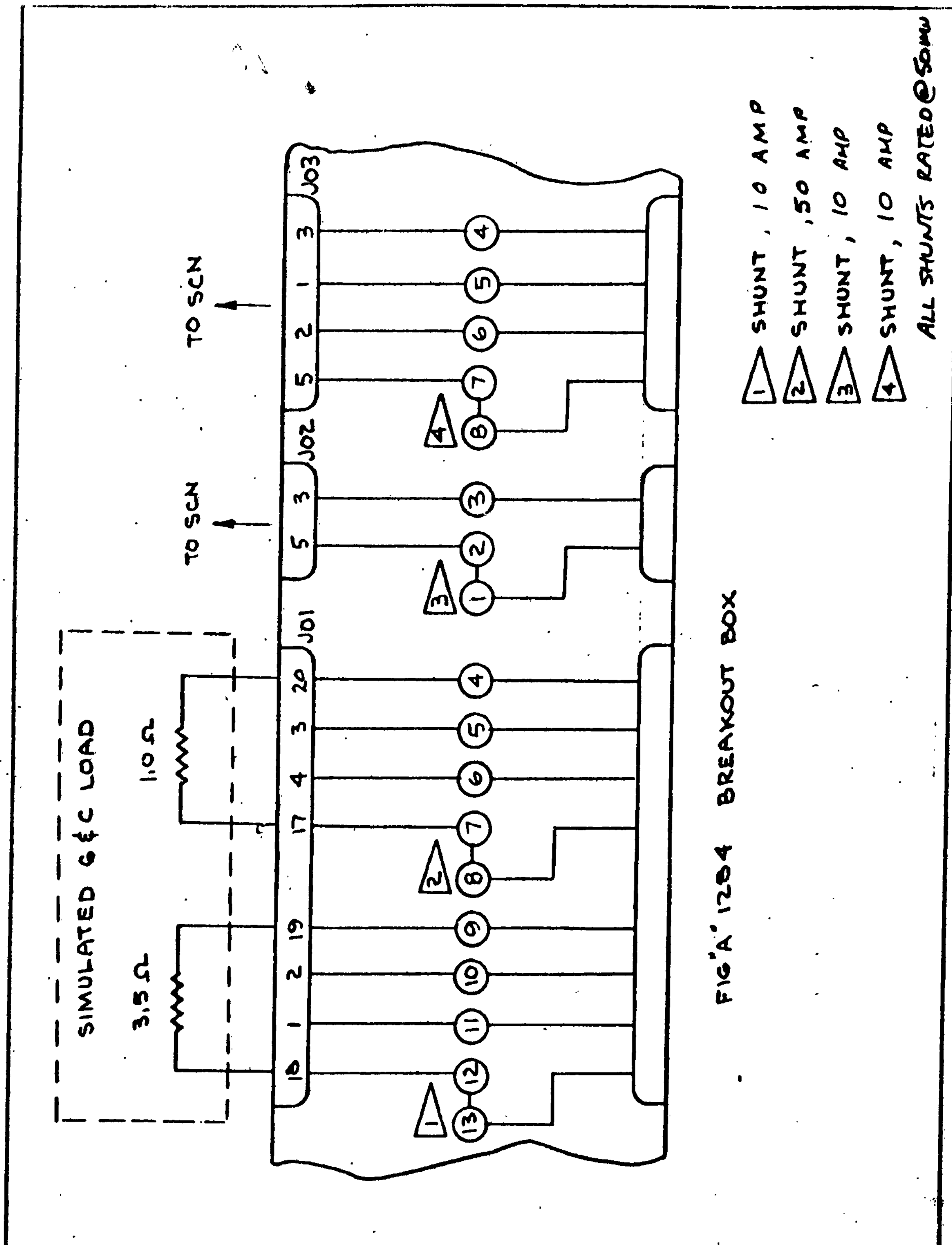
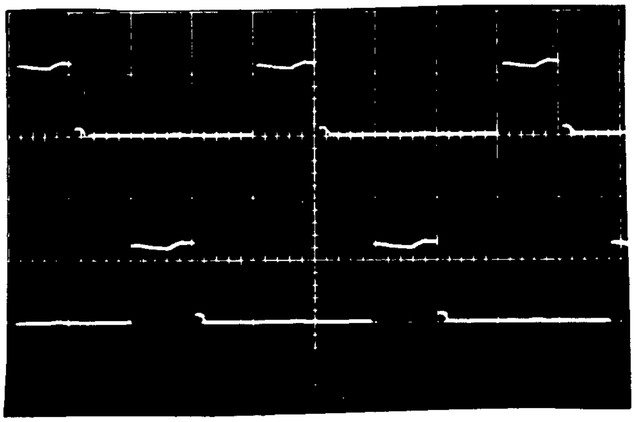


FIGURE 3.2.1.1-14

TEST 3.2.1.1



P/G Clock Pulses
Regulator Drawer, J1
Test Points. Pin 11
used as Common

TOP: J1-10

10 Volt/cm

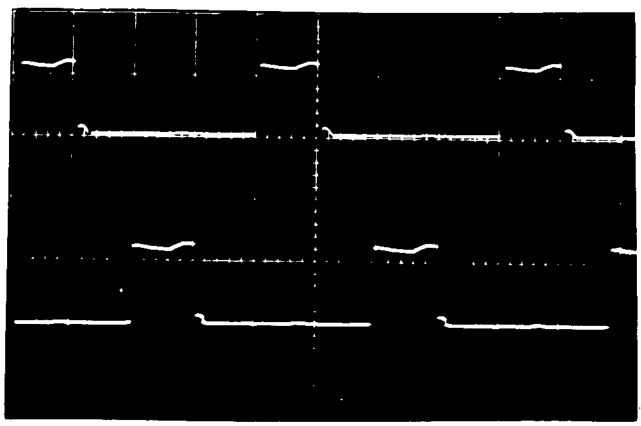
.1 ms/cm

BOTTOM: J1-6

10 Volt/cm

.1 ms/cm

Photo #1 400 ~ at 120 Volts



P/G Clock Pulses
Regulator Drawer, J1
Test Points. Pin 11
used as Common

TOP: J1-10

10 Volt/cm

.1 ms/cm

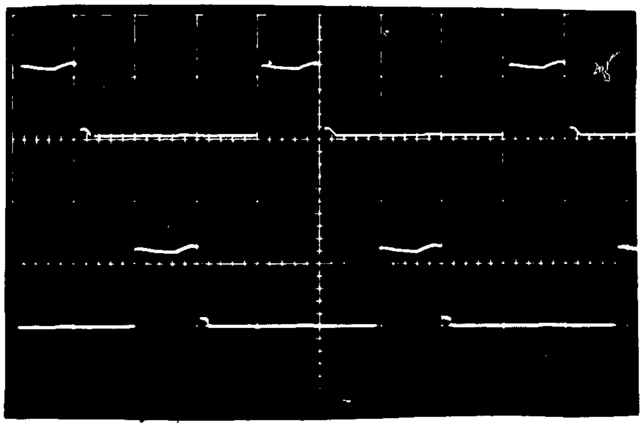
BOTTOM: J1-6

10 Volt/cm

.1 ms/cm

Photo #2 400 ~ at 110 Volts

TEST 3.2.1.1



P/G Clock Pulses
Regulator Drawer
J1 Test Points Pin 11
used as Common

TOP: J1-10

10 Volt/cm

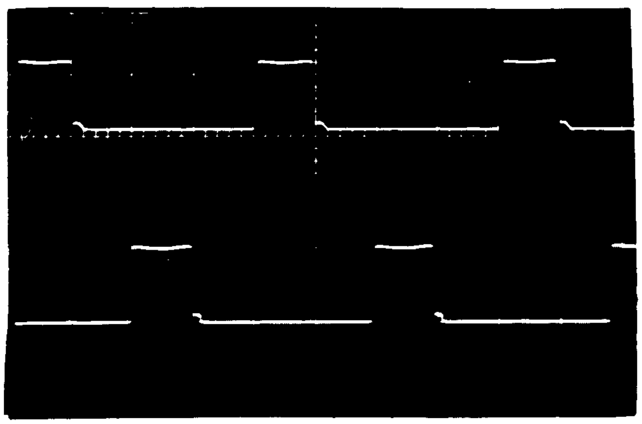
.1 ms/cm

BOTTOM: J1-6

10 Volt/cm

.1 ms/cm

Photo #3 400~ at 100 Volts



P/G Clock Pulses
Regulator Drawer
J1 Test Points, Pin 11
used as Common

TOP: J1-10

10 Volt/cm

.1 ms/cm

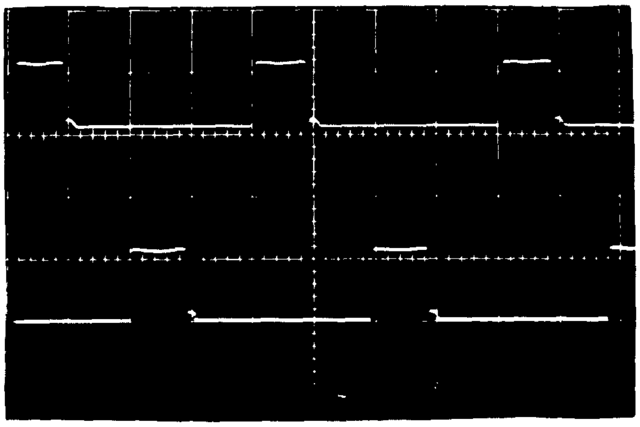
BOTTOM: J1-6

10 Volt/cm

.1 ms/cm

Photo #4 400~ at 90 Volts

TEST 3.2.1.1



P/G Clock Pulses
Regulator Drawer
J1 Test Points, Pin 11
used as Common

TOP: J1-10

10 Volt/cm

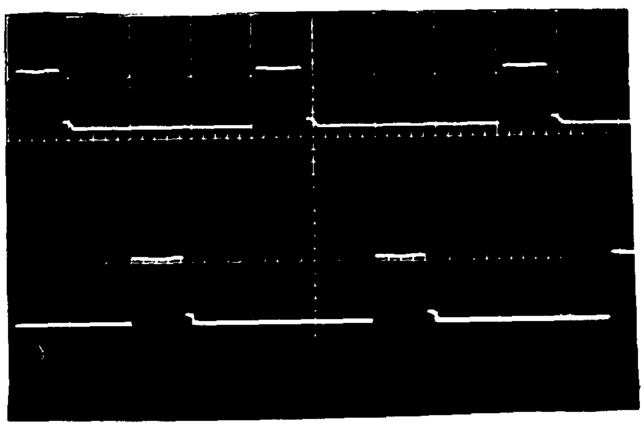
.1 ms/cm

BOTTOM: J1-6

10 Volt/cm

.1 ms/cm

Photo #5 400 ~ at 85 Volts



P/G Clock Pulses
Regulator Drawer, J1
Test Point, Pin 11
used as Common

TOP: J1-10

10 Volt/cm

.1 ms/cm

BOTTOM: J1-6

10 Volt/cm

.1 ms/cm

Photo #6 400 ~ Voltage at 80 Volts

TEST 3.2.1.1

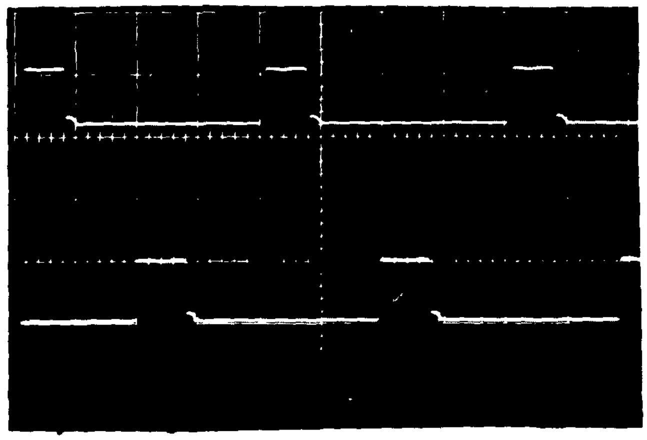


Photo #7 400∿ at 75 Volts

P/G Clock Pulses
Regulator Drawer
J1 Test Point
Pin 11 used as Common

TOP: J1-10

10 Volt/cm

.1 ms/cm

BOTTOM: J1-6

10 Volt/cm

.1 ms/cm

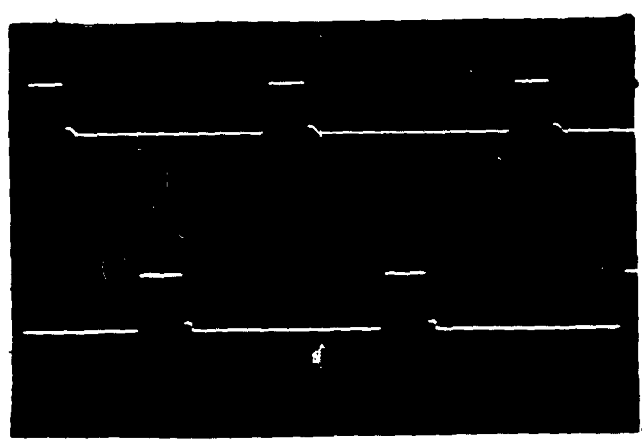


Photo #8 400∿ at 70 Volts

P/G Clock Pulses
Regulator Drawer
J1 Test Point
Pin 11 used as Common

TOP: J1-10

10 Volt/cm

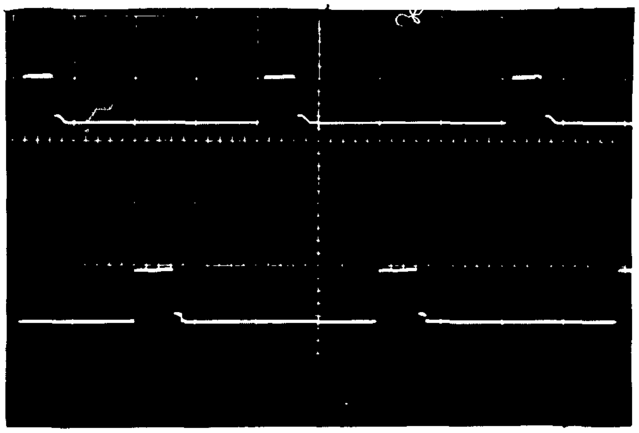
.1 ms/cm

BOTTOM: J1-6

10 Volt/cm

.1 ms/cm

TEST 3.2.1.1



P/G Clock Pulses
Regulator Drawer
J1 Test Point
Pin 11 used as Common

TOP: J1-10

10 Volt/cm

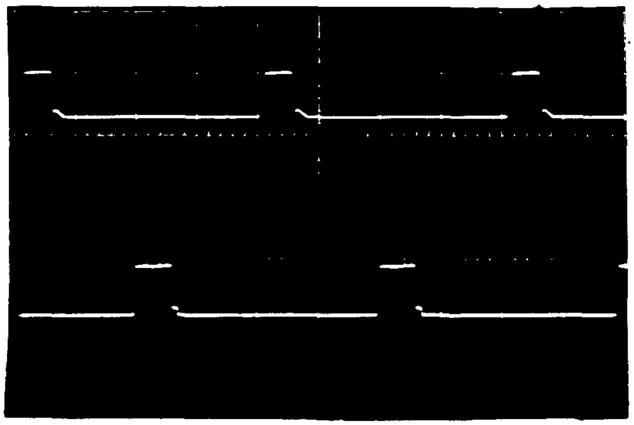
.1 ms/cm

BOTTOM: J1-6

10 Volt/cm

.1 ms/cm

Photo #9 400~ at 65 Volts



P/G Clock Pulses
Regulator Drawer
J1 Test Point
Pin 11 used as Common

TOP: J1-10

10 Volt/cm

.1 ms/cm

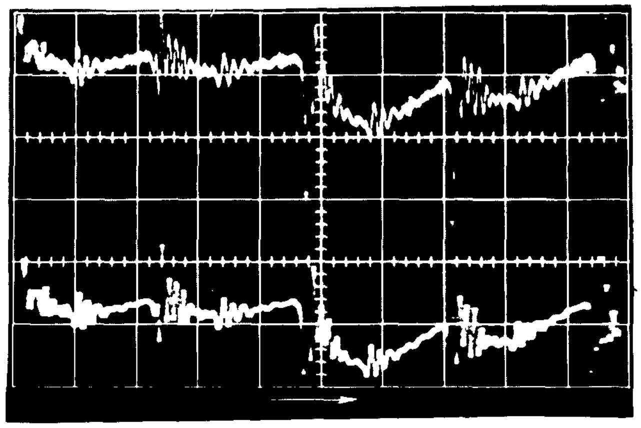
BOTTOM: J1-6

10 Volt/cm

.1 ms/cm

Photo #10 400~ Voltage at 60 Volts

TEST 3.2.1.1



TOP: Voltage Ripple

.1 Volt/cm

.2 ms/cm

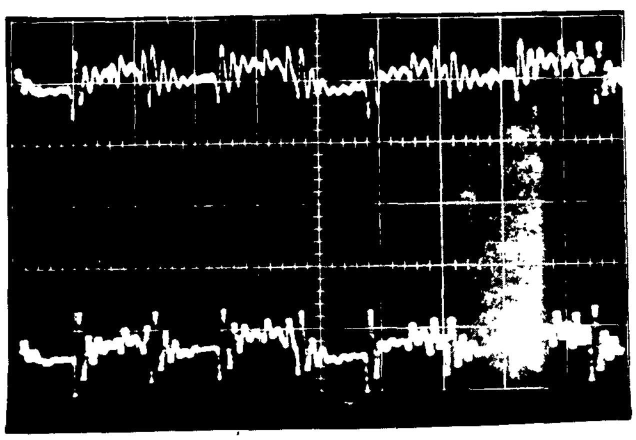
BOTTOM: Current

20 Amp/cm

.2 ms/cm

(AC Inputs)

Photo #11 Figure A 1284 DC Output to Figure A 1228. 400 ∿ input to Figure A 1284 at 120 VAC



TOP: Voltage Ripple

.1 Volt/cm

.2 ms/cm

BOTTOM: Current

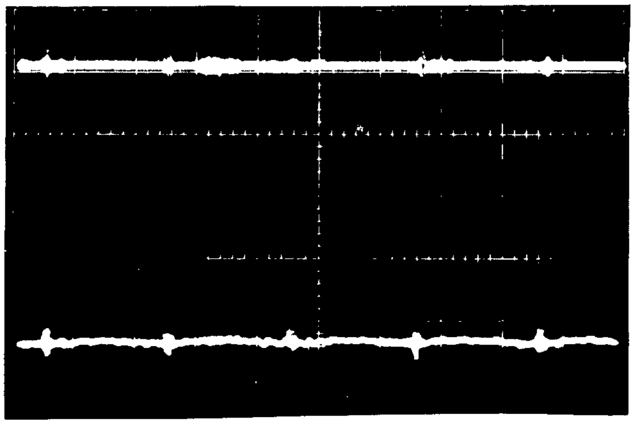
20 Amp/cm

.2 ms/cm

(AC Inputs)

Photo #12 Figure A 1284 DC Output to Figure A 1251. 400 ∿ input to Figure A 1284 at 120 VAC

TEST 3.2.1.1



TOP: Voltage Ripple

.05 V/cm

.2 s/cm

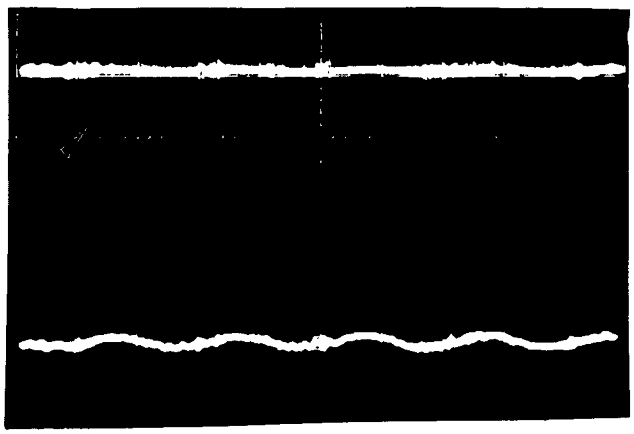
BOTTOM: Current

2 Amp/cm

.2 s/cm

(AC Inputs)

Photo #13 Figure A 1284 DC output to Resistive Load 400~ input to Figure A 1284 at 120 VAC



TOP: Voltage Ripple

.05 V/cm

.2 s/cm

BOTTOM: Current

10 Amp/cm

.2 s/cm

(AC Inputs)

Photo #14 Figure A 1284 DC output to Resistive Load 400~ input to Figure A 1284 at 120 VAC

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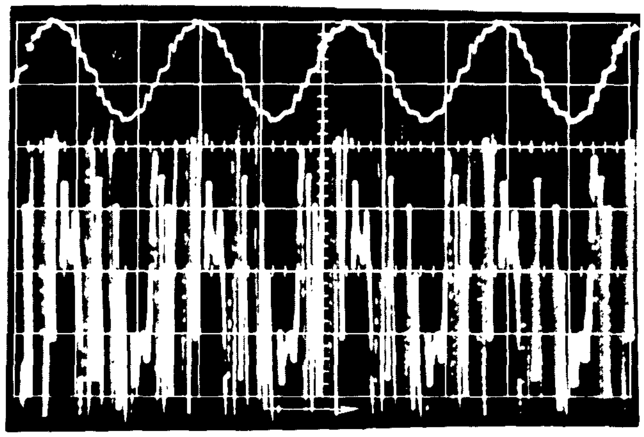
REV SYM B

TEST 3.2.1.1



TOP: ØA Voltage

200 V/cm

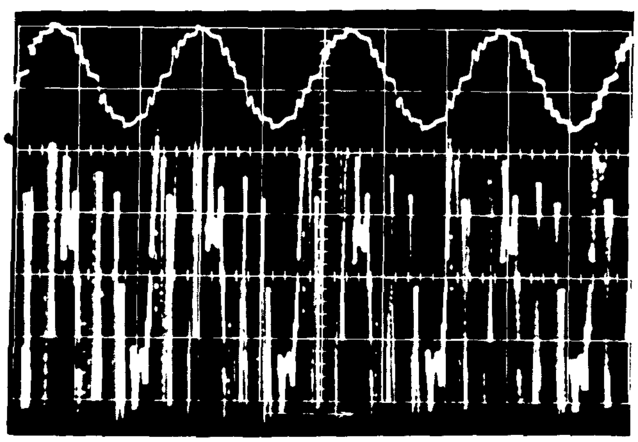
1 ms/cm

BOTTOM: ØA Current

12 A/cm

1 ms/cm

Photo #15 A_1A_4, A_2A_4 Security, 2A Monitor, P 3, Coupler, and both ØC electronic breakers depressed
400~ Input to Figure A 12A
at 120 VAC



TOP: ØA Voltage

200 V/cm

1 ms/cm

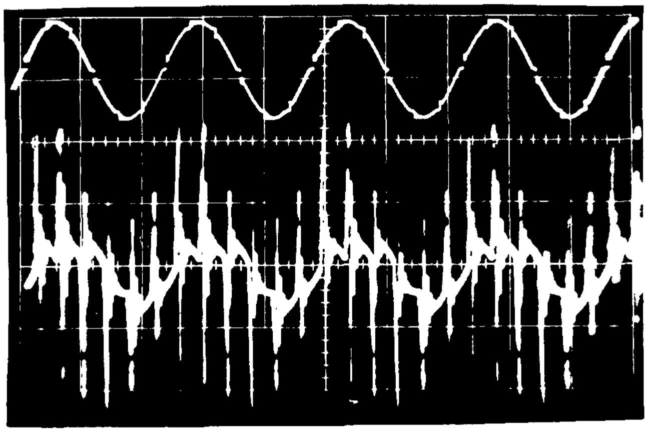
BOTTOM: ØA Current

12 A/cm

1 ms/cm

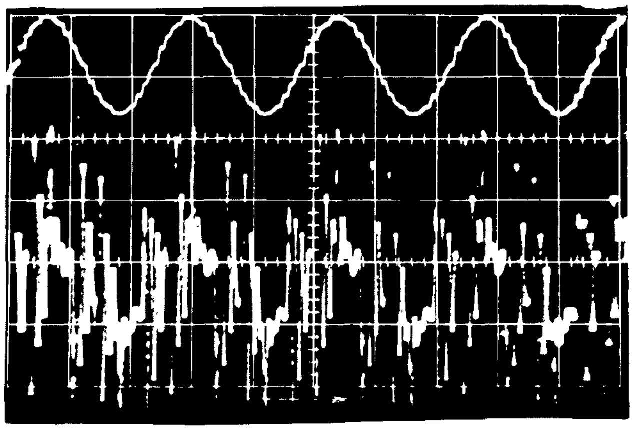
Photo #16 All breakers ON
Figure A 12A depressed,
30A backup ON.
400~ Input to Figure A 12A
at 120 VAC

TEST 3.2.1.1



TOP: Ø A Voltage
200 V/cm
1 ms/cm
BOTTOM: Ø A Current
12 V/cm
1 ms/cm

Photo #17 No Load Condition
400~ 120 V Input
to Figure A 1284
A_1 A_4, A_2 A_3, Breakers
of Figure A 1284 are
Depressed. P/G and Coupler
OFF



TOP: Ø A Voltage
200 V/cm
1 ms/cm
BOTTOM: Ø A Current
12 A/cm
1 ms/cm

Photo #18 P/G, Coupler, 400
Monitor, Security,
A_1 A_4, A_2 A_3 Breakers
ON.
400~ Input to Figure A
1284 at 120 VAC

TEST REPORT 3.2.1.2

1. TITLE

Programmer Group Load Test

2. OBJECTIVE

To obtain information on the power requriements of the Programmer Group.

3. CONCLUSIONS

3.1 Measured values of current were considerably lower than those given in D2-4853-1.

4. EQUIPMENT IN TEST

4.1 Programmer Group (403), P/N 25-22036-89, S/N 00000034.

5. TEST DESCRIPTION

5.1 The Programmer Group input power was monitored as shown in Figure 3.2.1.2-1.

5.2 Monitor power was applied to the Programmer Group and voltage, current, power, and frequency were monitored using the setup shown in Figure 3.2.1.2-1.

5.3 The Programmer Group was turned on.

5.4 Voltage outputs of the voltage regulator drawer in the Programmer Group were measured with a differential voltmeter. Ripple on each of the voltage levels was photographed. Clock voltages were also photographed.

5. TEST DESCRIPTION (Con't)

5.5 The turn off and turn-on of voltages in the voltage regulator drawer were recorded on magnetic tape. The tape was then played back at a slow speed into the oscillograph and oscillographic records of the on-off sequences were made.

5.6 One photograph of Ø 400 cycle input voltage was taken at the AC switch box.

6. TEST SUMMARY

6.1 Test results are summarized in Table 3.2.1.2-2.

6.2 Photographs of ripple and 400 cps voltage waveforms are included.

6.3 Turn-on and turn-off of Regulator Drawer outputs are shown in Oscillographs 3.2.1.2-1 through 3.2.1.2-4.

7. GENERAL INFORMATION

7.1 Test Engineer: Richard Mathias

7.2 Date test completed: April 3, 1963

7.3 Applicable ER's: U178447

7.4 Configuration: ECP 449, 479 and 487 are not incorporated in the Programmer Group

SUMMARY OF TEST RESULTS

1. 400 cps Input to Programmer Group

	Monitor Power Only	Operating Power	Difference (Regulated Power)
∅ A VOLTAGE	119.7 Volts	120.3 Volts	-
∅ B Voltage	119.8 Volts	120.4 Volts	-
∅ C Voltage	119.8 Volts	120.6 Volts	-
∅ A Current	.65 Amps	.79 Amps	.13 Amps
∅ B Current	.62 Amps	.79 Amps	.17 Amps
∅ C Current	.62 Amps	.75 Amps	.13 Amps
W_2 Wattmeter	130 Watts	150 Watts	20 Watts
W_3 Wattmeter	93 Watts	116 Watts	23 Watts
Total Real Power (P)	223 Watts	266 Watts	43 Watts
Total Reactive Power (Px)	64 Watts	59 Watts	5 Watts
Power Factor (P. F.)	.96	.98	-
Phase Angle	+16.26°	12.5°	-
Frequency	419 cps	419 cps	-

$P = W_2 + W_3$

$Px = \sqrt{3}\,(W_2 - W_3)$

$P.F. = \frac{P}{\sqrt{P^2 + Px^2}}$

Phase Angle = $\tan^{-1} \frac{P}{Px}$

TABLE 3.2.1.2-1

2. Measured DC Voltage at Programmer Group Regulator Drawer

Test Point	Nominal Voltage	Measured Voltage
J1-2	-10.0	-10.013
J1-3	-10.0	-10.028
J1-4	+10.0	+10.016
J1-5	+10.0	+10.002
J1-9	+28.0	+28.040
J1-12	+28.0	+28.057
J1-13	+34.0	+36.089
J1-14	+17.0	+17.265
J1-15	+11.5	+11.502
J1-16	+15.0	+17.182
J1-17	-15.0	-17.252

Power common was J1-11 on the voltage Regulator Drawer

TABLE 3.2.1.2-2

Data Source	Voltage	Quantity of Power Reqd.		Power Factor	Average Amps/ Ø
		Watts (Total	Vars (Total		
D2-4853-1	400 cps 120/208V	485	492	0.7	1.9
Test 3.2.1.2	419 cps 120/208V	266	59	.98	.79

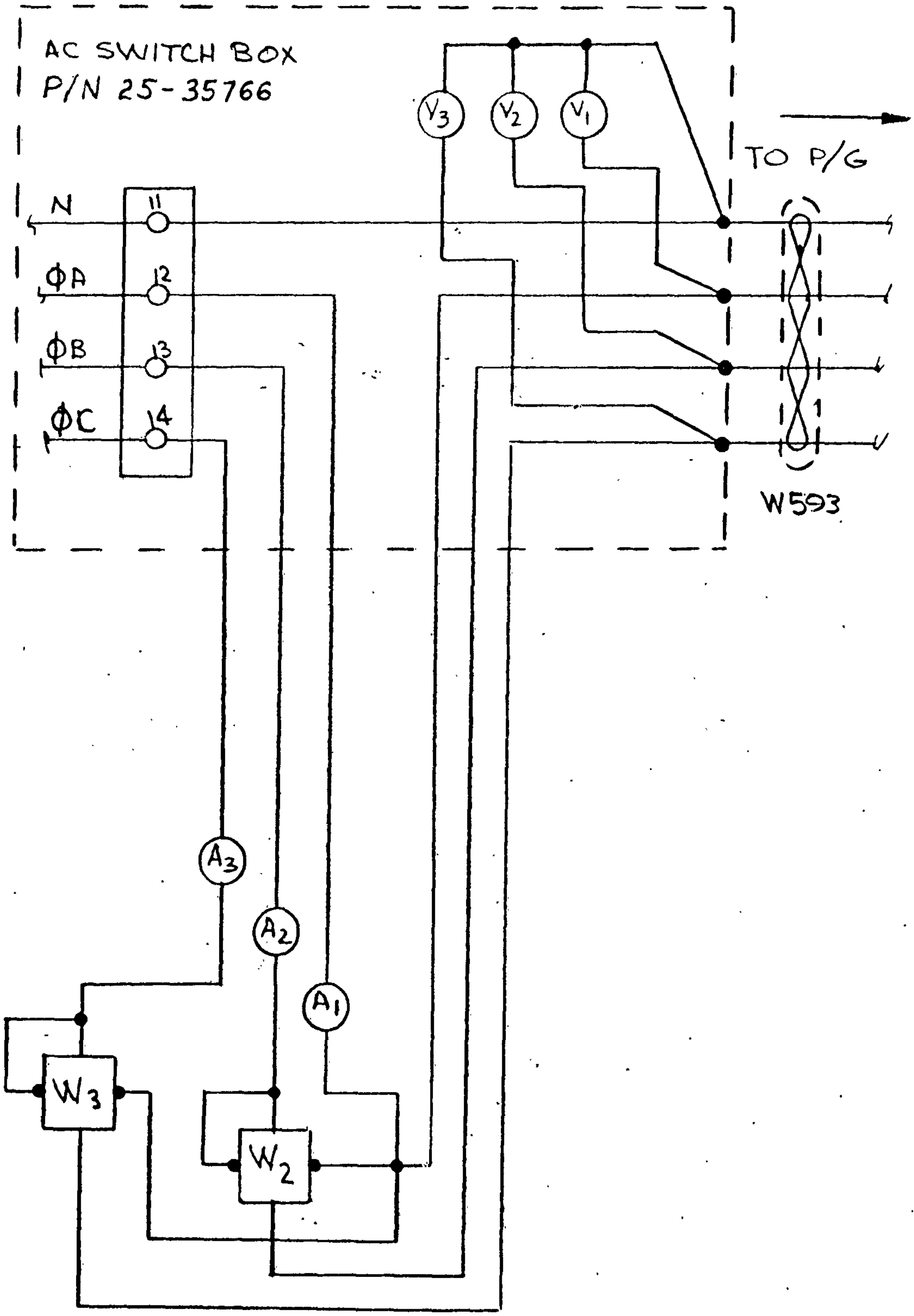


FIGURE 3.2.1.2-1

TEST 3.2.1.2

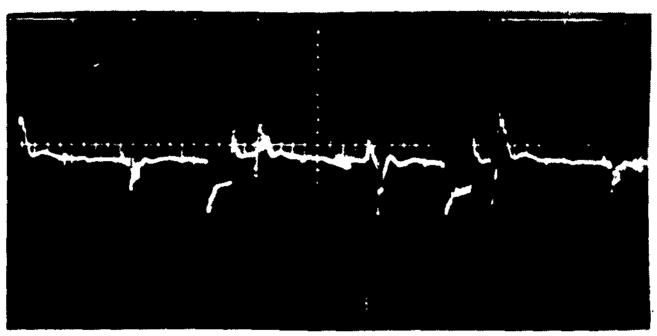
Ac Input

0.1 volt/cm

50 μsec/cm

Photo #1 Nominal - 10 VDC, P/G Power Supply

J1-2, J1-11 Common



Ac Input

0.05 volt/cm

50 μsec/cm

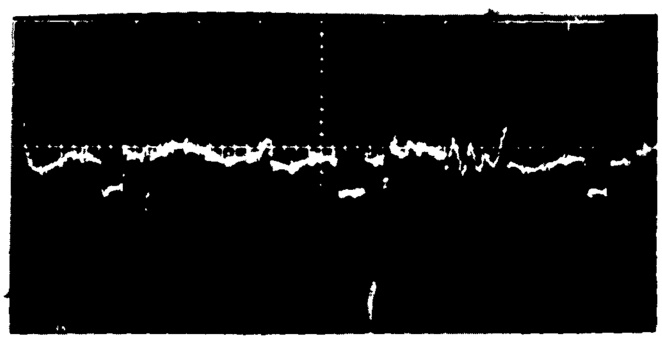
Photo #2 Nominal - 10 VDC, P/G Power Supply

J1-3, J1-11 Common

TEST 5.2.1.2

AC Input
0.05 volt/cm
50 μsec/cm

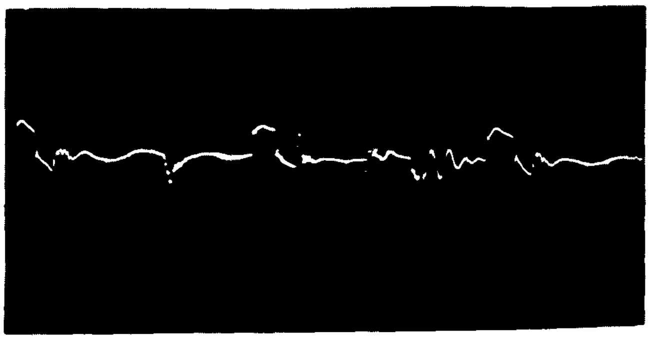
Photo #3 Nominal +10 VDC, P/6 Power Supply
J1-4, J1-11 Common



AC Input
0.1volt/cm
50 μsec/cm

Photo #4 Nominal +10VDC, P/6 Power Supply
J1-5, J1-11 Common

TEST 5.2.1.2



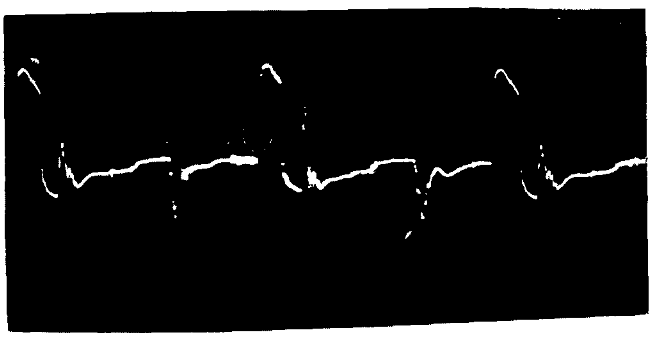
AC Input

0.1 volt/cm

50 μsec/cm

Photo #5 Nominal +28 VDC, P/G Power Supply

J1-9, J1-11 Common



AC Input

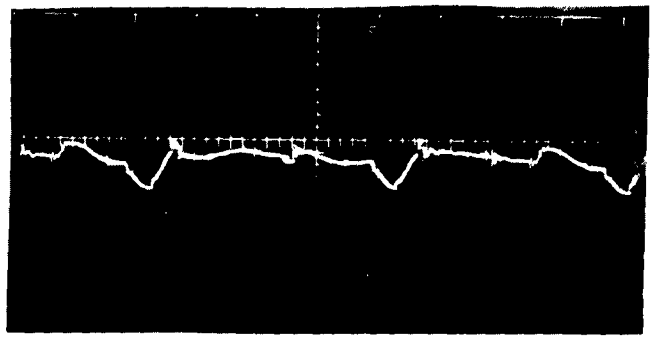
0.05 volt/cm

50 μsec/cm

Photo #6 Nominal +28 VDC, P/G Power Supply

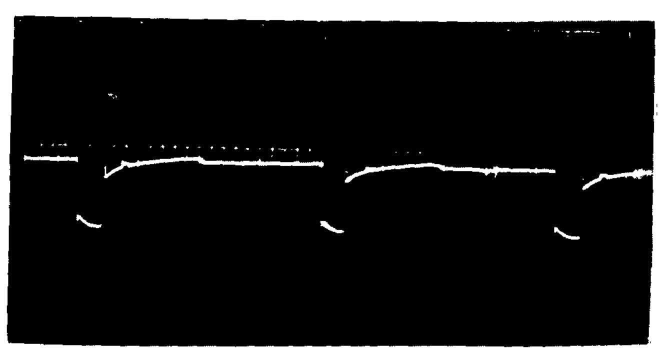
J1-12, J1-11 Common

TEST 3.2.1.2



AC Input
0.1 volt/cm
50 μsec/cm

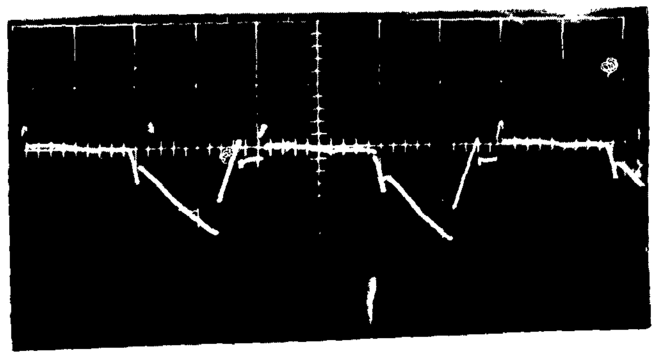
Photo #   Nominal +34 VDC , P/6 Power Supply
J1-13 monitored
J1-11 return



AC Input
0.5 volt/cm
50 μsec/cm

Photo #   Nominal +17 VDC , P/6 Power Supply
J1-14 monitored
J1-11 return

TEST 3.2.1.2



AC Input
0.5 volt/cm
50 μsec/cm

Photo #   Nominal +11.5 VDC, P/G Power Supply
J1-15 monitored
J1-11 return

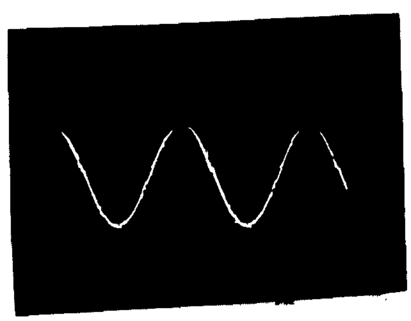
AC Input
0.1 volt/cm
50 μsec/cm

Photo #   Nominal +15 VDC, P/G Power Supply
J1-16 monitored
J1-11 return

TEST 3.2.1.2

AC Input
0.1 volt/cm
50 μsec/cm

Photo #11 Nominal -15 VDC, P/G Power Supply
J1-17 monitored
J1-11 return



100 volts /cm
0.5 ms/cm

Photo #15 400 cps input to Programmer Group
monitored at AC Switch Box
10:1 Attenuator Probe used.

TEST 3.2.1.2

5 volts/cm
0.1 ms/cm

Photo #

P/G Clock Voltage
Regulator drawer J1-6 monitored
J1-11 return

5 volts/cm
0.1 ms/cm

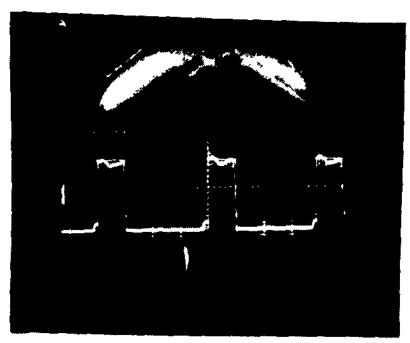


Photo #

P/G Clock Voltage
Regulator drawer J1-10 monitored
J1-11 return

TEST 3.2.1.2

10 volts/cm
0.1 ms/cm

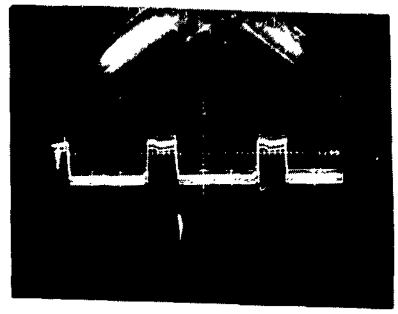


Photo #

P/G Clock Voltage
Regulator drawer J1-8 monitored
J1-11 return

10 volts/cm
0.1 ms/cm

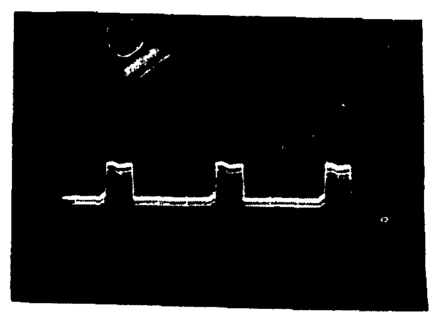


Photo #

P/G Clock Voltage
Regulator drawer J1-7 monitored
J1-11 return

TEST 3.2.1.2

Both traces

10 volts/cm
0.1 ms/cm

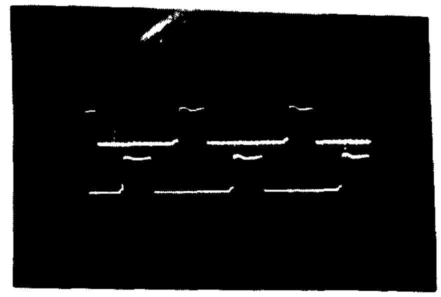


Photo #	P/G Clock Voltages
top trace J1-10
bottom trace J1-6
J1-11 return

Both traces

10 volts/cm
0.1 ms/cm

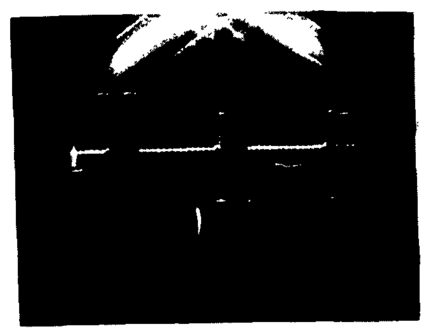
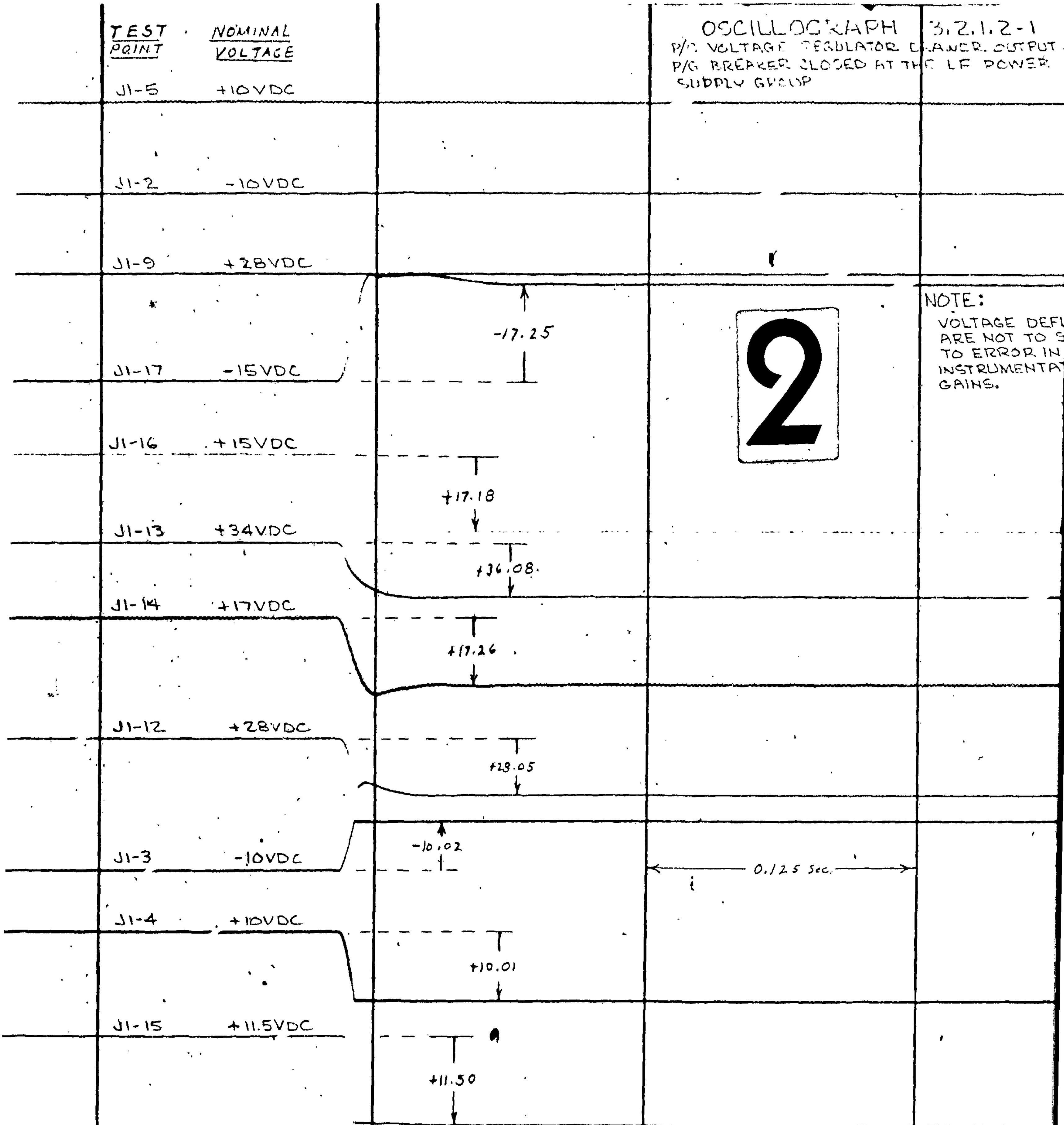


Photo #	P/G Clock Voltages
top trace J1-8
bottom trace J1-7
J1-11 return

1

OSCILLOGRAPH 3.2.1.2-1
P/G VOLTAGE REGULATOR CHANGE OUTPUT
P/G BREAKER CLOSED AT THE LF POWER
SUPPLY GROUP



NOTE:
VOLTAGE DEFL
ARE NOT TO S
TO ERROR IN
INSTRUMENTA
GAINS.

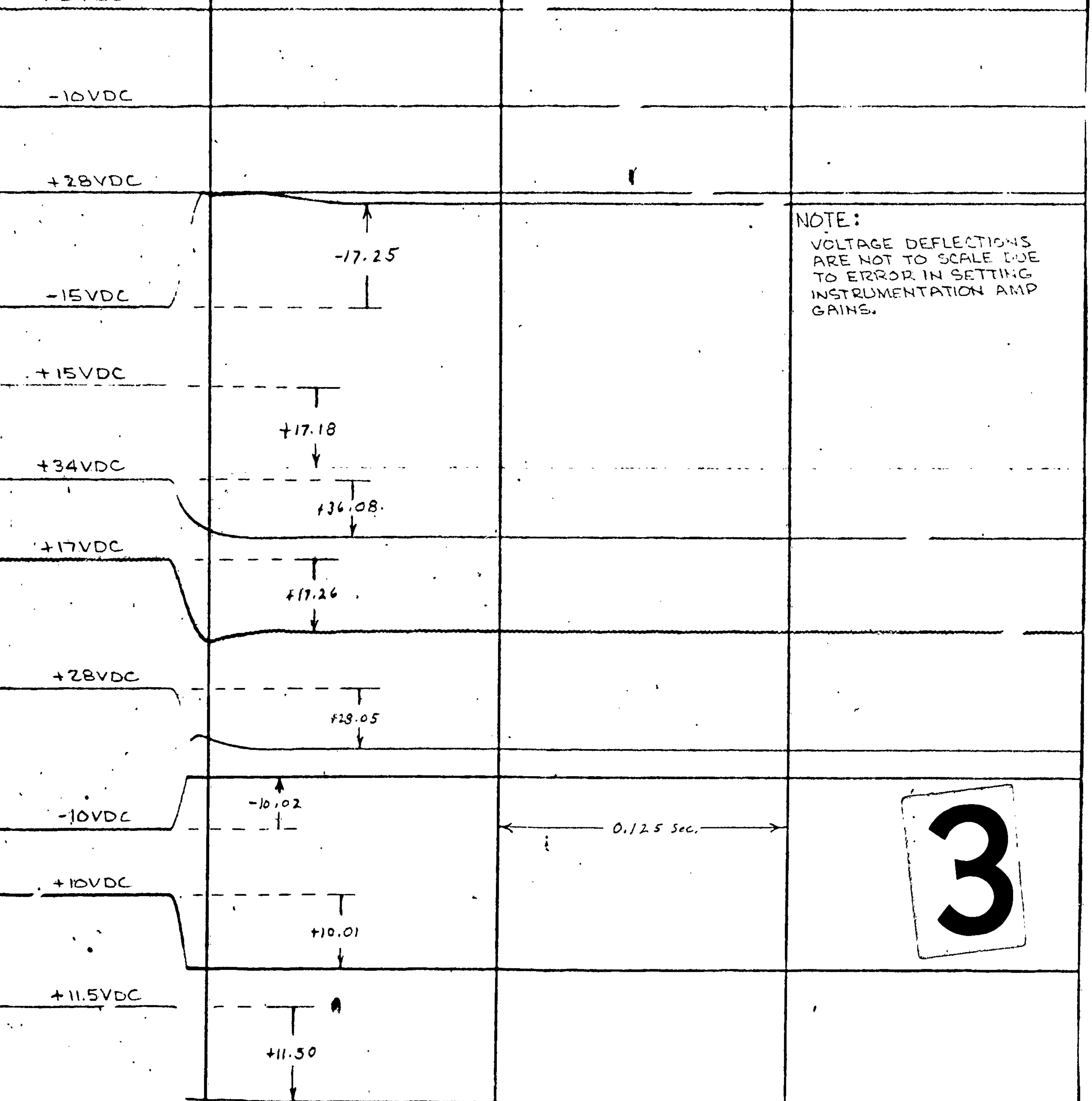
2

REV SYM B

NO. III

SECT. D

OSCILLOGRAPH 3.2.1.2-1
P/G VOLTAGE REGULATOR CLANER. OUTPUT – P/G BREAKER CLOSED AT THE LF POWER SUPPLY GROUP



NOTE:
VOLTAGE DEFLECTIONS ARE NOT TO SCALE DUE TO ERROR IN SETTING INSTRUMENTATION AMP GAINS.

3

REV SYM B

J1-5

J1-2

J1-9

J1-17

J1-

J1-1

J1-1

1

J1-1

J1-3

J1-4

J1-1

Oscillograph 3.2.1.2-2
P/G Voltage regulator driver outputs - P/G & Courier Power On button depressed at LF Startup Unit

0 volts to +10 volts

J1-5 +10VDC

-10.02

J1-2 -10VDC

J1-9 +28VDC

J1-17 -15VDC

+28.04

J1-16 +15VDC

J1-13 +34VDC

J1-14 +17 VDC

J1-12 +28VDC

J1-3 -10VDC

2

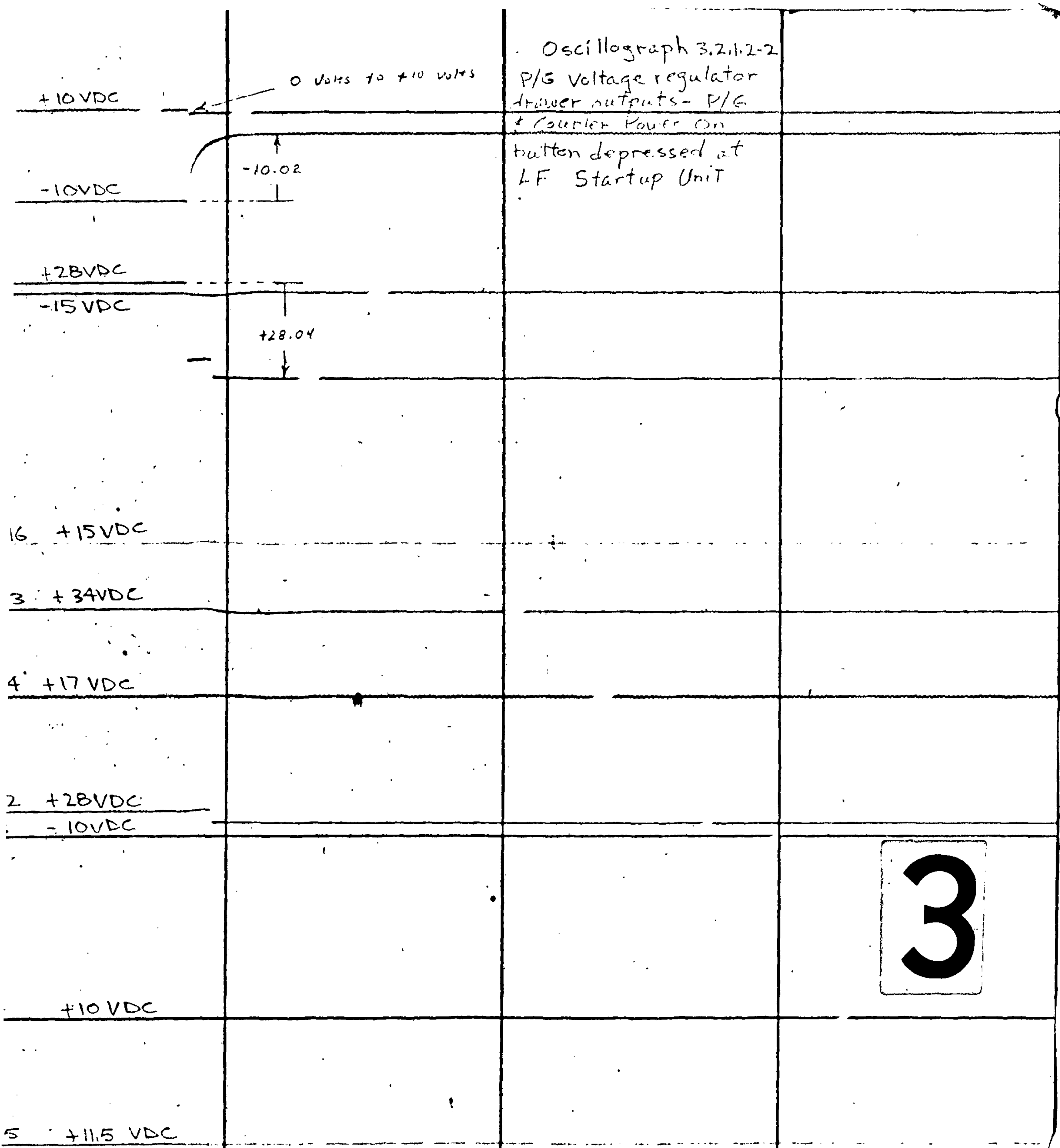
J1-4 +10 VDC

J1-15 +11.5 VDC

REV. SYM. B

NO. III

SECT. D



Oscillograph 3.2.1.2-2
P/G Voltage regulator
driver outputs - P/G
& Coupler Power On
button depressed at
LF Startup Unit
0 Volts to +10 volts
+10 VDC
-10.02
-10VDC
+28VDC
-15 VDC
+28.04
16 +15VDC
3 +34VDC
4 +17 VDC
2 +28VDC
-10VDC
+10 VDC
5 +11.5 VDC

3

REV. SYM. B

			[illegible]
			[illegible]
			J1-9
			J1-17
			J1-16
			J1-13
			J1-14
			J1-12
			J1-3
			J1-4
			J1-15

1

OSCILLOGRAPH 3.1.1.2-

P/S VOLTAGE REGULATOR [illegible] WITH [illegible] OUTPUT [illegible] SIDE [illegible] BOTTOM [illegible] EXPECTED

J1-5 [illegible] VDC

J1-[illegible] [illegible] VDC

J1-9 +[illegible]2 VDC

J1-17 -15VDC

J1-16 +15VDC

J1-13 +34 VDC

J1-14 +17VDC

J1-12 +28VDC

2

J1-3 - [illegible]VDC

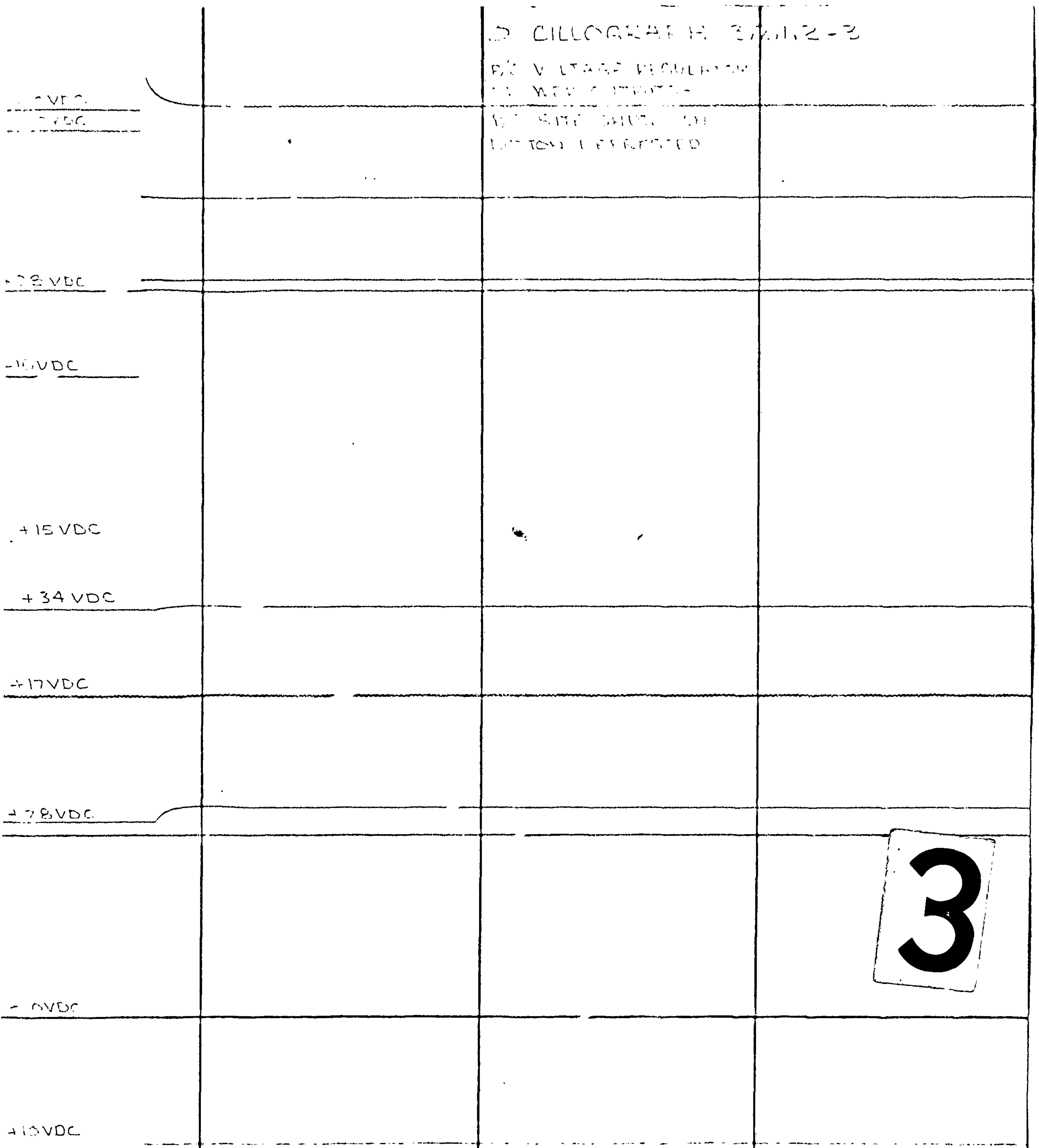
J1-4 +15VDC

REV. SYM. B

J1-15 +11.5VDC

NO. III

SECT. D



REV. SYM. B

NO. III

SECT. D PAGE

J1-5

J'-2

J1-9

J1-17

J1-16

J1-13

J1-14

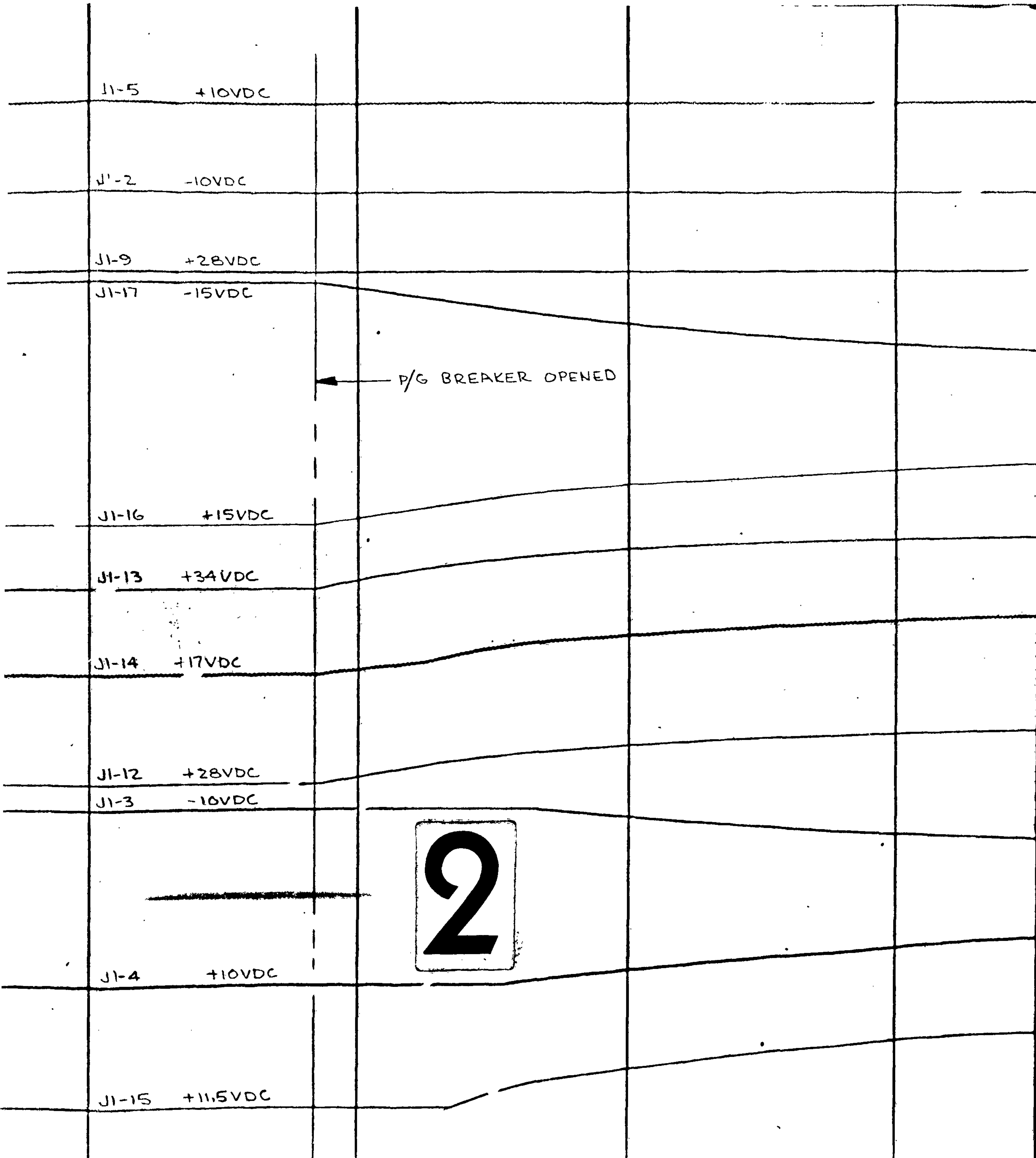
J1-12

J1-3

1

J1-4

J1-15


J1-5 +10VDC
J'-2 -10VDC
J1-9 +28VDC
J1-17 -15VDC
P/G BREAKER OPENED
J1-16 +15VDC
J1-13 +34VDC
J1-14 +17VDC
J1-12 +28VDC
J1-3 -10VDC
2
J1-4 +10VDC
J1-15 +11.5VDC

OSCILLOGR

P/C VOLTAGE RE

P/G POWER BRE

3

REV. SYM B

OSCILLOGRAPH 3.2.1.2-4

P/G VOLTAGE REGULATOR DRAWER OUTPUTS -
P/G POWER BREAKER OPENED AT 1 F POWER GROUP

4

TEST REPORT 3.2.1.3

1. TITLE

G&C Coupler Load Test

2. OBJECTIVES

To provide information on the 400 cycle power requirements of the G&C Coupler (Wing II).

3. CONCLUSIONS

Average Steady-State current for the G&C Coupler was less than listed in D2-4853-1, which shows 0.8 amps/phase for G&C coupler and collimator set.

4. EQUIPMENT IN TEST

G&C Coupler (Wing II), P/N 55103-107, SIN AHB 0003

5. TEST DESCRIPTION

5.1 Instrumentation was connected to the AC Switch Box as shown in Figure 3.2.1.3-1.

5.2 The Coupler was turned on.

5.3 Measurements of line current, phase voltage, frequency, and power were taken.

6. SUMMARY OF TEST RESULTS

ø A Voltage = 120.06 volts

ø B Voltage = 120.37 volts

ø C Voltage = 120.20 volts

ø Current = .47 Amps

ø Current = .545 Amps

ø Current = .56 Amps

W_2 = 51 Watts

W_3 = 109 Watts

Test Report 3.2.1.3—Summary of Test Results (Con't)

Real Power = 160 Watts

Reactive Power = 104

Power Factor = .838

Frequency = 419 cps

7. GENERAL INFORMATION

7.1 Test Engineer: Richard Mathias, 2-6519-14

7.2 Date Test completed: 4/5/63

7.3 Applicable E R's: None

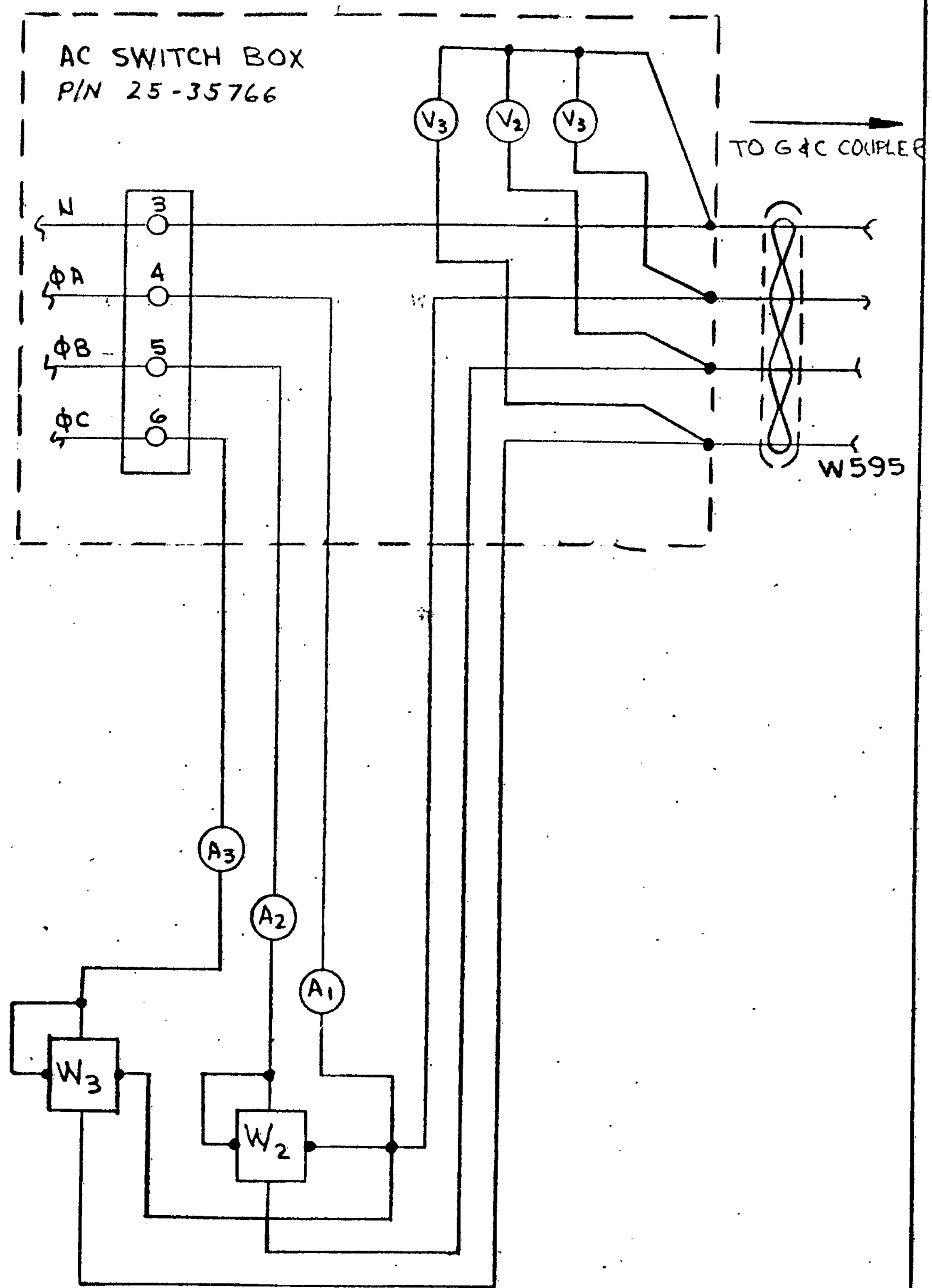


FIGURE 3.2.1.3-1

TEST 3.2.1.3

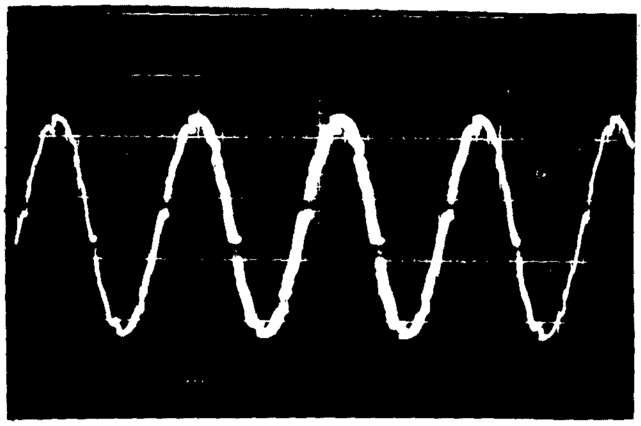


Photo #1 400 cps input to G&C Coupler

10 volt/cm using a 10X1 Attenuator Probe

1 ms/cm

TEST REPORT 3.2.1.4

1. TITLE

LF/SCN Load Test

2. OBJECTIVES

To determine the power requirements of the LF/SCN racks. (Digital Data Group and Status - Command Message Processing Group).

3. CONCLUSIONS

3.1 The steady-state values of current for the two LF/SCN racks were slightly less than those given in D2-4853-1, the difference being less than one ampere. Transient values of current and voltage were close, but recovery times were considerably better than those listed in D2-4853-1. Ripple measured at the input to the racks was much larger than the limits given in D2-4853-1. A comparison at Data is given in Table 3.2.1.4-2.

3.2 The current transients to the LF/SCN had the same magnitude regardless of converter breaker or rack turn-on sequences. The only difference observed was a slight ringing with the converter breakers closed at turn-on. Peak current was approximately 112 amperes. The photographs at the end of this report show the turn-on voltage and current transients.

3.3 Ripple at the input to the LF/SCN was within the limits of D2-4853-1, with the racks turned OFF. When the racks were turned on, the ripple increased, due to the noisy chopper circuits of the SCN power supplies. The noise from the DDG

3. CONCLUSIONS 3.3 (cont'd)

on the D. C. input was approximately twice that of the S-CMPG. When one rack was turned off and the other left on, the noise from the rack with power on was not coupled back through the SCN filters to the input of the rack without power.

3.4 The current drawn by both racks when the 36 amp supply was turned ON and OFF was approximately 60 amperes. The current peak of the S-CMPG occurred sooner than that of the DDG by a few milliseconds (See photograph no. 8).

4. EQUIPMENT IN TEST

4.1 Digital Data Group (DDG) P/N 8323616-505, S/N 0000005.

4.2 Status - Command Message Processing Group P/N 8323617-504, S/N 0000005.

4.3 Power Supply Group P/N 25-22552-36, S/N 0002.

5. TEST DESCRIPTION

5.1 The equipment was connected per Figure 3.2.1.4-1. Shunts were installed in the positive line of the D. C. input. All breakers supplying power to the SCN were closed on the LF Power Group, and turn-on of the racks performed by operating the main breaker on the front of each rack.

5.2 Voltage measurements were made with a Differential voltmeter. Current transients were photographed using a 10 amp, 50 mv standard shunt and a tektronix Differential preamp in a type

5. TEST DESCRIPTION (Con't)

555 oscilloscope (with camera). Voltage transients were measured with a Type CA preamp. Reference was structure ground, which was less than 0.1 volt below the power return. The following conditions for turn-on were used:

A. Turn-on of S-CMPG

(1) DDG OFF, S-CMPG converter breakers OFF

(2) DDG OFF, S-CMPG converter breakers ON

(3) DDG ON, S-CMPG converter breakers ON

B. Turn-on of DDG

(1) S-CMPG ON, DDG converter breakers OFF

(2) S-CMPG ON, DDG converter breakers ON

(3) S-CMPG OFF, DDG converter breakers ON

5.3 Steady-state current was measured using the same shunts as in 5.2 and a Differential Voltmeter. Measurements were made with:

A. Both racks ON

B. Racks ON alternately

C. Racks ON alternately with converter breakers ON one at a time.

5.4 Ripple was photographed at the input to the racks with:

A. Both racks ON

B. Both racks OFF

C. DDG ON, S-CMPG OFF

D. S-CMPG ON, DDG OFF

5.5 The effects of an uncontrolled shut down and restoration of power were investigated by opening and closing the breaker supplying power to the 30 Amp power supply which, in turn, supplies the SCN racks. Photographs were made of the current surge (see Photo #8).

6. TEST SUMMARY

6.1 The trigger used for the transient pictures was J2-A. D.C. coupling was used for all pictures of transients. AC coupling was used for the pictures of ripple.

6.2 Two calibrated 10 amp, 50 mv shunts were used for all current measurements. Therefore, in the pictures of current transients every 50 mv of deflection represents 10 amps of current.

6.3 A summary of test results is given in Table 3.2.1.4-2. A comparison of test results with D2-4853-1 is given in table 3.2.1.4-1.

6.4 The photographs of current transients show the current going to a near zero level after the initial surge. The current does not increase again until the +6 volts in the SCN power supplies sequences ON (see Photo #7).

7. GENERAL INFORMATION

7.1 Test Engineer: Norman Noe

7.2 Date Test completed: 5/2/63

7.3 Charged to EWA 8956

7.4 Open E R's on Equipment tested:

7. GENERAL INFORMATION (Con't)

U201477	U039176	U187410	E491033
U201097	U150095	U187512	E491041
U150099	U150046	U147572	U201037
U048656	U178426	U147540	U042693
U147476	U147428	U147562	U039184
U147526	U147524	U147567	U147455
U147439	U147525	E386147	
U201477	U147570	E491078	

Data Source	Rack	Steady State Voltage	Start-up Time to SS Limit (ms)	Voltage Transient		Ripple Limits		Current Inrush [1]	INPUT				Duty Cycle
				Excursion % Nominal	Recovery Time (ms)	P-P Volts	Freq.		Peak [2] Amps	Peak [2] Watts	Average Amps	Average Watts	
D2-4853-1	S-CMPG	28 Volts	25 ms	± 43	25 ms	0.3	2400	2.25 KVA	[3] 27	[3] 784	11.0	310	Cont.
"	DDG	28 Volts	25 ms	±43	25 ms	0.3	2400	2.0 KVA	[3] 27	[3] 784	10.4	290	Cont.
3.2.1.4	S-CMPG	28.9Volts	—	-37	5 ms	2.0	2200	112 Amps	—	—	10.34	290	Cont.
"	DDG	28.9Volts	—	-37	5 ms	4.1	2200	112 Amps	—	—	10.9	305	Cont.

[1] Listed as Inrush KVA in D2-4853.

[2] LF (P/G and Coupler) were in Strategic Alert, SCN was Sending Status Back to LCF.

[3] Total for both racks

TABLE 3.2.1.4-1

Rack Tested	Condition	Steady State Current	Current In-rush at Turn-On	Voltage Drop at Turn-On	Ripple Magnitude Volts p-p
S-CMPG	DDG OFF, All Converter Breakers OFF	10.24 Amps	112 Amps	10 Volts	
S-CMPG	DDG OFF, -9V Breaker ON	10.38 Amps			
S-CMPG	DDG OFF, -9V & +28 Volt 2 Amp Breakers ON	10.34 Amps			
S-CMPG	DDG OFF, All Converter Breakers ON	10.34 Amps	112 Amps	10 Volts	2.1
S-CMPG	DDG ON, All Converter Breakers ON	10.36 Amps	112 Amps	5 Volts	2.0
S-CMPG	DDG ON, -9V Breaker OFF	10.36 Amps			
S-CMPG	DDG ON, -9 & +28 Volt 2A Breakers OFF	10.36 Amps			
S-CMPG	DDG ON, All Breakers OFF.	10.40 Amps			
DDG	S-CMPG OFF, All Converter Breakers OFF	8.30 Amps			
DDG	S-CMPG OFF, -9V Breaker ON	8.40 Amps			
DDG	S-CMPG OFF, -9V & +28 Volt 2 Amp Breakers ON	8.82 Amps			
DDG	S-CMPG OFF, All Converter Breakers ON	10.90 Amps	112 Amps	7 Volts	2.8
DDG	S-CMPG ON, All Converter Breakers ON	9.76 Amps	112 Amps	6 Volts	4.1
DDG	S-CMPG ON, -9V Breaker OFF	9.64 Amps			
DDG	S-CMPG ON, -9 & +28 Volt 2 Amp Breakers OFF	9.30 Amps			
DDG	S-CMPG ON, All Converter Breakers OFF	8.60 Amps	112 Amps	7 Volts	
S-CMPG & DDG	Both Racks OFF				0.22

TABLE 3.2.[illegible].4-2

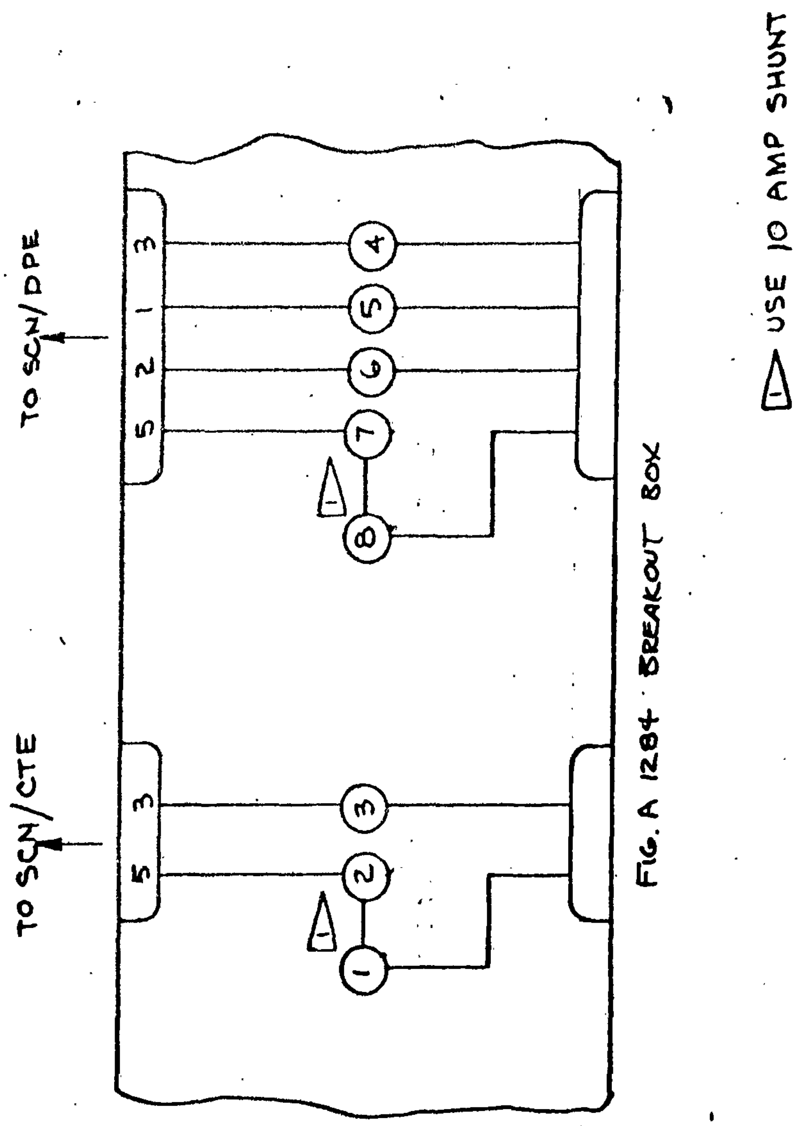


FIGURE 3.2.1.4-1

TEST 3.2.1.4

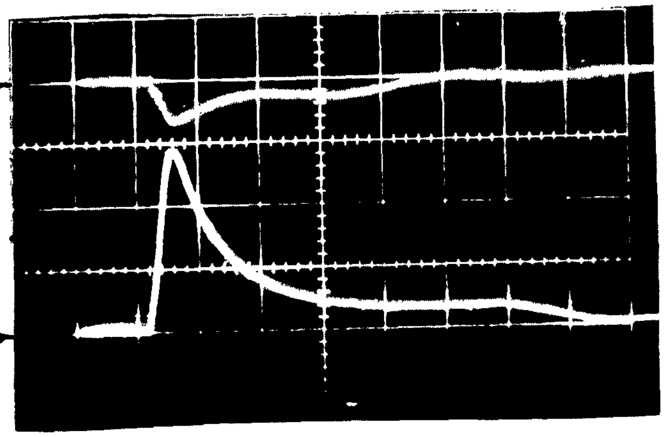


Photo #1 LF/DDG POWER TURN-ON TRANSIENTS
DDG converter breakers OFF, S-CMPG rack ON
Top trace: Input voltage, A7/J2-A. 10v/cm, 1ms/cm
Lower trace: Current, Pos. line. 200mv/cm, 1ms/cm
Positive trigger from J2-A

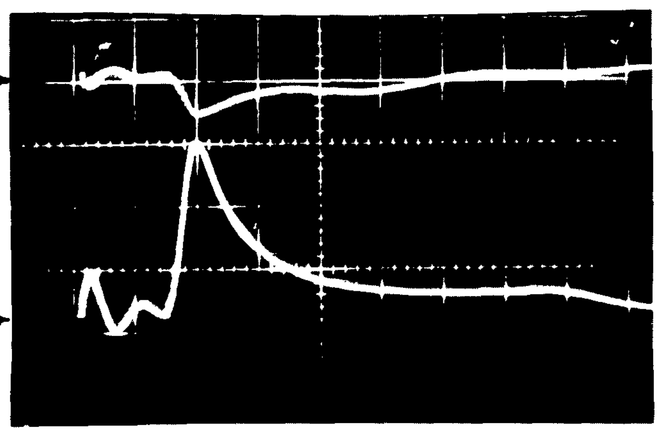


Photo #2 LF/DDG POWER TURN-ON TRANSIENTS
DDG converter breakers ON, S-CMPG rack ON
Top trace: Input voltage, A7/J2-A. 10v/cm, 1ms/cm
Lower trace: Current, pos. line. 200mv/cm, 1ms/cm
Positive trigger from J2-A

TEST 3.2.1.4

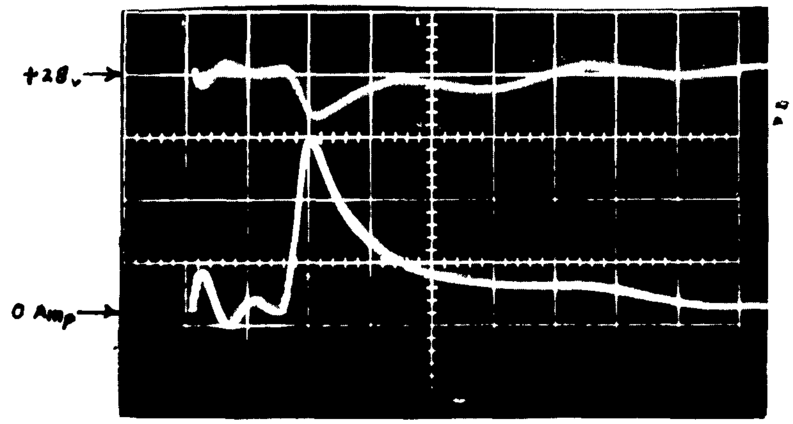


Photo #3 LF/DDG POWER TURN-ON TRANSIENTS
DDG converter breakers ON, S-CMPG rack OFF
Top trace: Input voltage, A7/J2-A. 10v/cm, 1ms/cm
Lower trace: Current, pos. line. 200 mv/cm, 1ms/cm
Positive trigger from J2-A

TEST 3.2.1.4

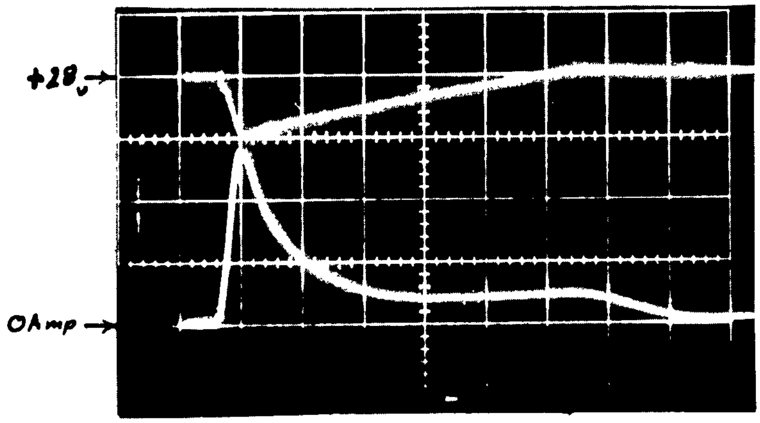


Photo #4 S-CMPG POWER TURN-ON TRANSIENTS
DDG rack OFF, S-CMPG converter breakers OFF
Top trace: Input voltage, A7/J2-A. 10v/cm, 1ms/cm
Lower trace: Current, pos. lone. 200mv/cm, 1ms/cm
Positive trigger from J2-A

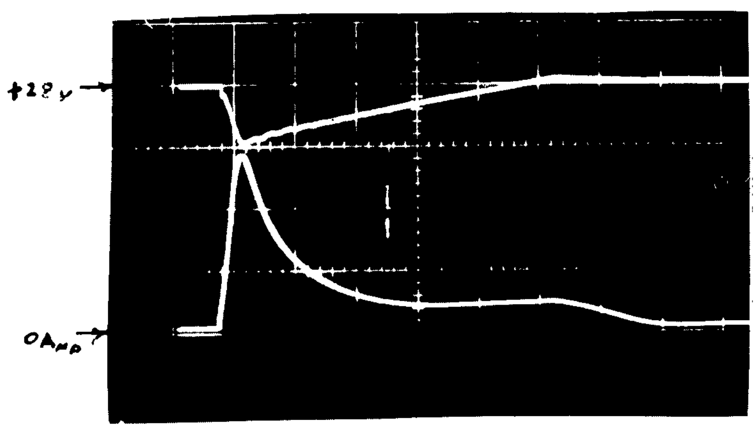


Photo #5 S-CMPG POWER TURN-ON TRANSIENTS
DDG rack OFF, S-CMPG converter breakers ON
Top trace: Input voltage, A7/J2-A. 10v/cm.1ms/cm
Lower trace: Current, pos. line. 200mv/cm, 1ms/cm
Positive trigger from J2-A

TEST 3.2.1.4

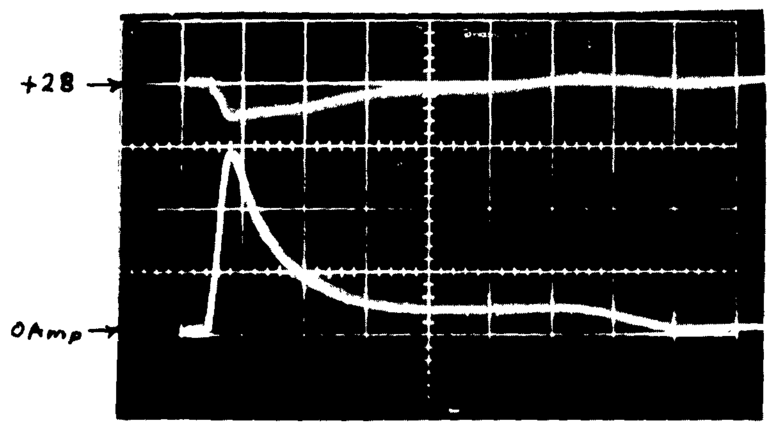


Photo #6 S-CMPG POWER TURN-ON TRANSIENTS
DDG rack ON, S CMPG converter breakers ON
Top trace: Voltage, A7/J2-A. 10v/cm, 1ms/cm
Lower trace: Current, pos. line. 200mv/cm, 1ms/cm
Positive trigger from J2-A

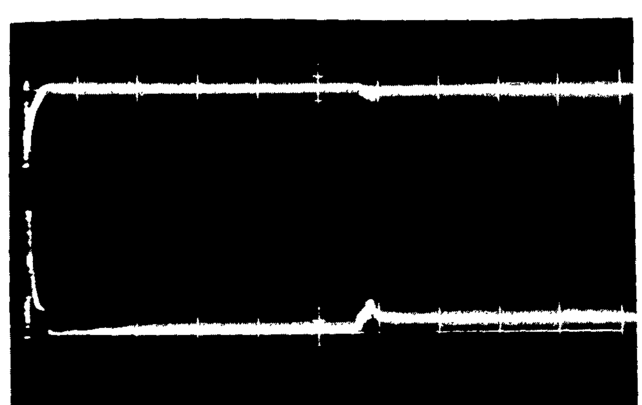


Photo #7 DDG POWER TURN-ON TRANSIENTS, SLOW SWEEP
S-CMPG rack off, converter breakers on.
Upper trace: Voltage 20v/cm, 20ms/cm.
Lower trace: Current 200mv/cm, 20ms/cm.
Current trace is voltage drop across a
10 amp, 50mv standard shunt.

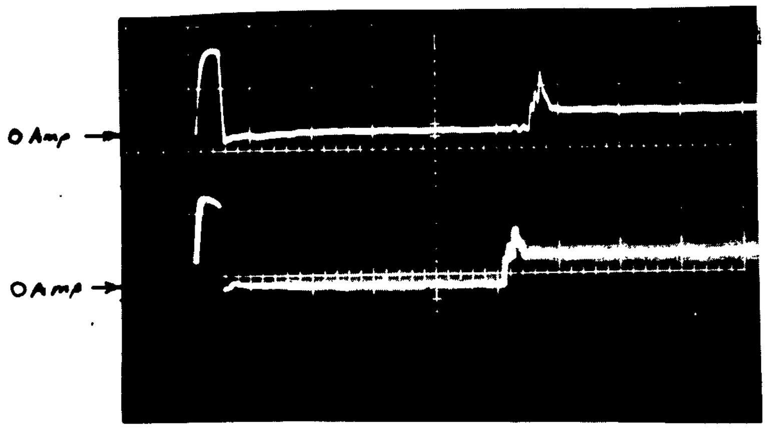


Photo #8 SIMULTANEOUS TURN-ON OF LF/SCN RACKS
All converter breakers and main circuit breakers on DDG and S-CMPG CLOSED. Turn-on performed by depressing circuit breaker #5 on Fig. A 1284
Top trace: Current, DDG. 100mv/cm, 20ms/cm
Lower trace: Current, S-CMPG. 100mv/cm, 20ms/cm
Positive trigger from J2-A

TEST 3.2.1.4

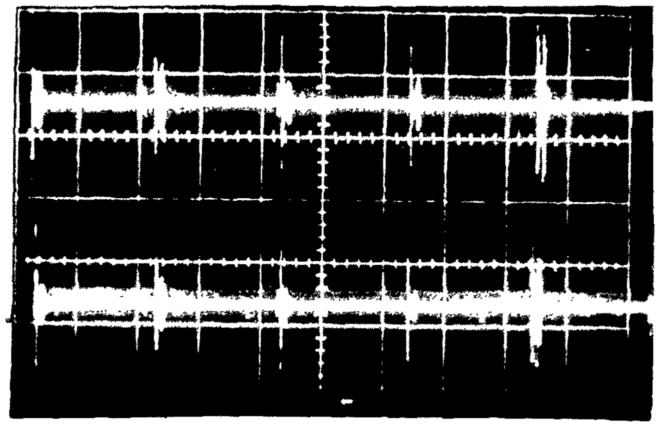


Photo #9 RIPPLE AT INPUT TO LF/SCN, BOTH RACKS TURNED OFF
Top trace: S-CMPG J1-3 to 5. 0.1v/cm, 0.2ms/cm
Lower trace: DDG J1-3 to 5. 0.1v/cm, 0.2ms/cm
A.C. coupling, single sweep

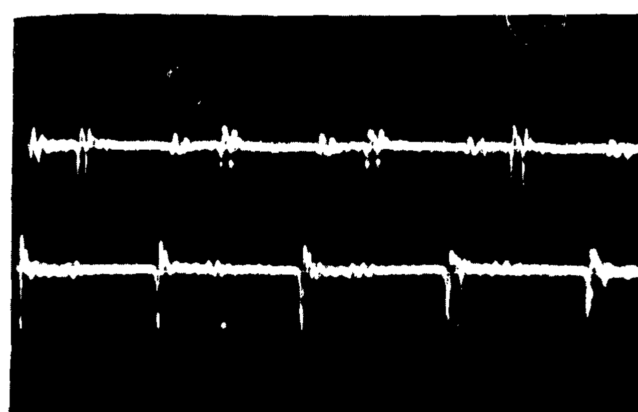


Photo #10 RIPPLE AT INPUT TO LF/SCN, BOTH RACKS TURNED ON
Top trace: S-CMPG/A7/J2-A to B. 2v/cm, 0.2ms/cm
Lower trace: DDG/A7/J2-A to B. 2v/cm, 0.2ms/cm
A.C. coupling, single sweep.

TEST 3.2.1.4

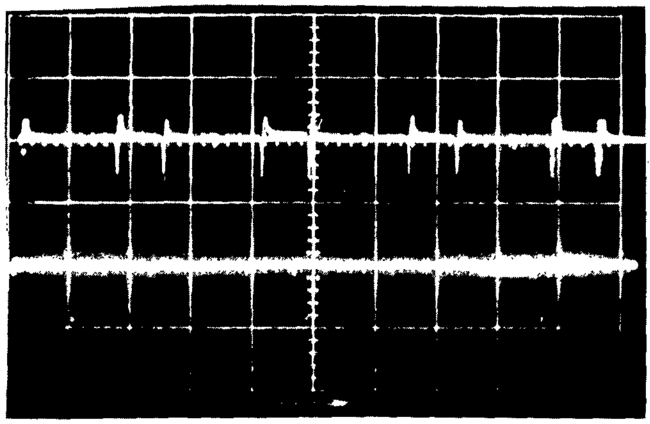


Photo #11 RIPPLE AT INPUT TO LF/SCN, DG OFF, S-CMPG ON
Top trace: S-CMPG/A7/J2-A to B. 2v/cm, 0.2 ms/cm
Lower trace: DDG/A7/J2-A to B. 2v/cm, 0.2ms/cm
A.C. coupling, 1/100th at f5.6

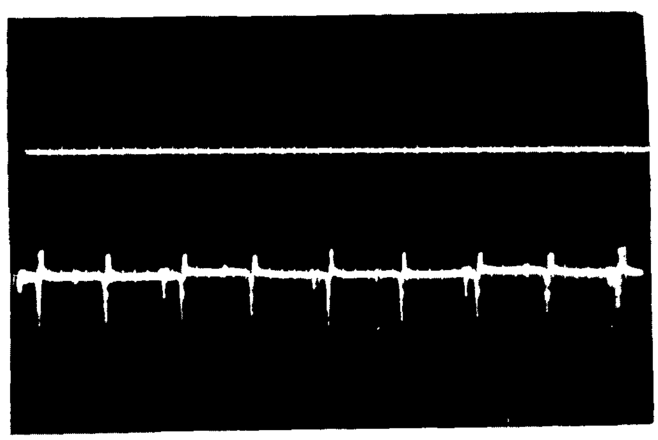
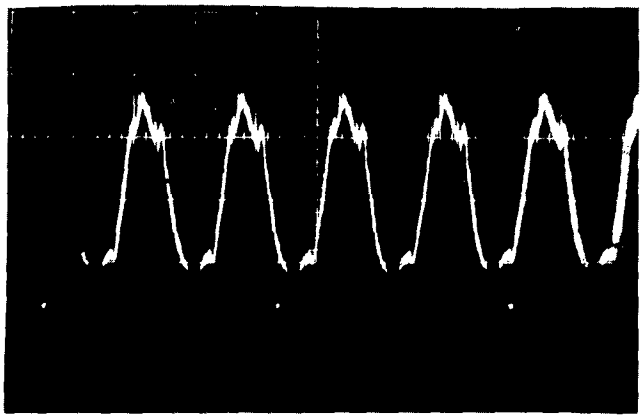


Photo #12 RIPPLE AT INPUT TO LF/SCN, DDG ON, S-CMPG OFF
Top trace: S-CMPG/A7/J2-A to B. 2v/cm, 0.2 ms/cm
Lower trace: DDG/A7/J2-A to B. 2v/cm, 0.2ms/cm
A.C. coupling, 1/100th at f5.6

TEST 3.2.1.4



0.1 volt/cm

10 ms/cm

Photo #13 Racks 401 and 402 off

J2-A Monitored @ LF/DDG

J2-B Common

AC Trigger

U3 4288 2000 REV. 8/62

2-5142-2

REV SYM B

TEST REPORT 3.2.1.5

1. TITLE

LF Load Test, Safety Control Switch

2. OBJECTIVES

To determine the D.C. power requirements of the Safety Control Switch (SCS) in the Main Distribution Box.

3. CONCLUSIONS

3.1 The SCS control circuit has a slight ringing when the switch is safed or armed. Ring frequency was 1 Mega cycle. Peak current was 1.5 amperes when the switch went from Armed to Safe.

3.2 Large noise spikes were observed on the G & C power supply line (J02-26 referenced to 27) when the SCS was activated. The noise was less than 7 µs in duration but had a peak magnitude of 60 volts p-p (See photographs). There was no load on the G & C power supply lines.

3.3 Activation time and peak current values measured were less than specified in D2-4853-1 (See Table 3.2.1.5-1).

4. EQUIPMENT IN TEST

4.1 Safety Control Switch in Main Distribution Box. P/N 25-23468-32 S/N 0003.

4.2 LF/DDG, P/N 8323616 -505, S/N 0000005

4.3 Power Group, LF, P/N 25-22552-36, S/N 0002.

5. TEST DESCRIPTION

5.1 A 50 mv, 5 amp shunt was installed in the positive line

5. TEST DESCRIPTION 5.1 (Con't)

of the G & C Power supply line from the LF Power Group.

5.2 Cable W531 (P18) and W548 (P02) were disconnected from the Distribution Box.

5.3 The LF Power Group and LF/SCN racks were turned on.

5.4 The SCS was safed and Armed from the Arming & Status panel of the Communications Control panel. Photographs were taken of current transients.

5.5 Pins 26 & 27 of P02 were monitored with an oscilloscope while the switch was being safed and armed. Photographs of noise transients were taken.

5.6 A 50 mv 5 amp shunt was installed in J27-9 and the switch safedmand armed. Photographs were made of transients.

5.7 The SCS was locked in Safe position with the Safing Tool. The Arm Switch on the CCC was activated. Current to the switch was measured under this blocked rotor condition.

5.8 Activation time was measured.

6. TEST SUMMARY

6.1 Current transients were photographed using a Tektronix type D preamp. Reference was the return of the G & C power supply line.

6.2 Reference for the current transient measurements on the motor control line was structure ground.

6.3 Test results are summarized in table 3.2.1.5-1.

7. GENERAL INFORMATION

7.1 Test Engineer: Norman Noe

7. GENERAL INFORMATION (Con't)

7.2 Date test completed: 5/4/63

7.3 Applicable E R's:

(a) Distribution Box:

U147372	U147547
U147521	U147548
U147471	U147465
U147472	

(b) LF/DDG:

U309176	U147439
U150095	U147524
U150046	U147525
U178426	U147540
U147428	U147562
U147570	U147567
U187410	U187512
	U147572

(c) LF Power Group:

E386147	U042693
E491078	U039184
E491033	E44037
E491041	

Condition	Peak Current	Voltage	Control Input Peak Transients	Activation Time	Current Duration
Safe to Armed	1.8 amps	27.62	0.24	20 ms	23.5 ms
Armed to Safe	1.8 amps	27.62	1.5	40 ms	23.5 ms
Arming Signal while Safing Tool is in place	1.96 amps	27.62	—	—	Continuous
D2-4853-1	3	28	—	—	100 ms

TABLE 3.2.1.5-1

TEST 3.2.1.5

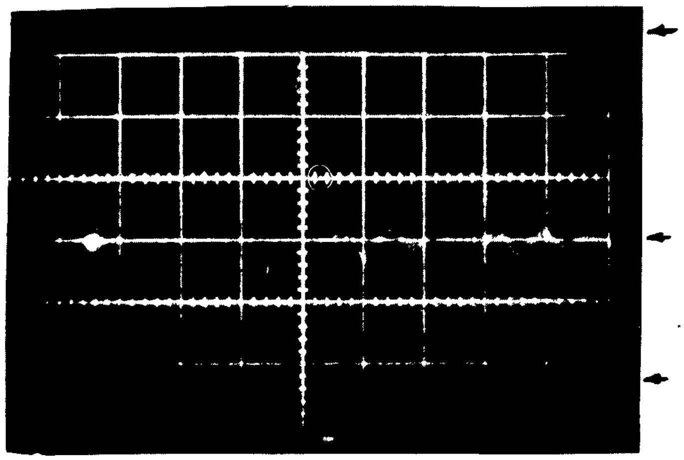


Photo #1 NOISE ON G&C POWER SUPPLY LINE, J02-26 ref. to 27
SCS driving to ARM position, G&C power ON.
10v/cm, 1μs/cm.

TEST 3.2.1.5

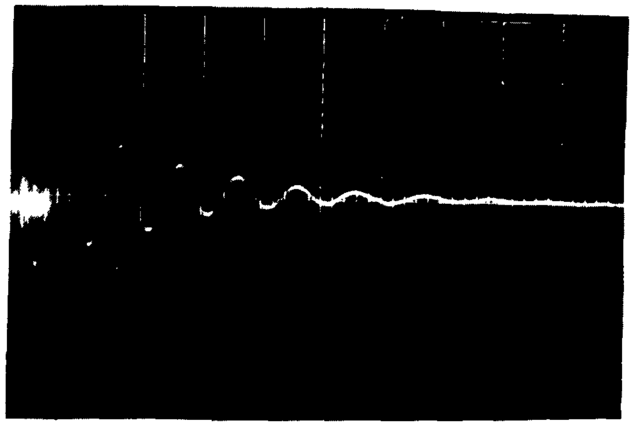


Photo #2 SCS MOTOR CONTROL INPUT, CURRENT TRANSIENTS
Trace is voltage across a 50 mv/5amp shunt, inserted in line to J27-9. 1mv/cm, 1μs/cm, referenced to structure ground, SCS is being ARMED

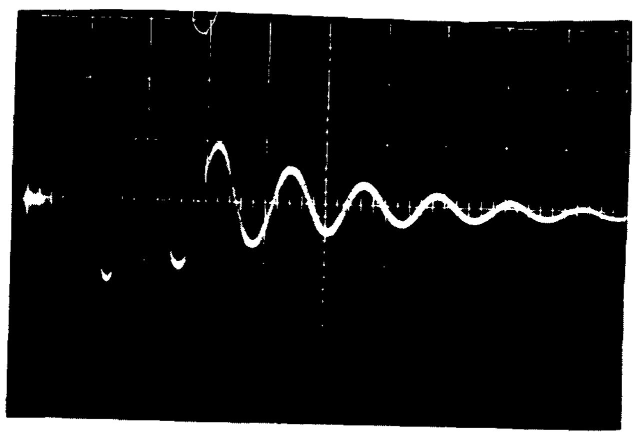


Photo #3 SCS MOTOR CONTROL INPUT, CURRENT TRANSIENT
Trace is voltage across a 50mv/5amp shunt, inserted in line to J27-9. 5mv/cm, 1μs/cm, referenced to structure ground. SCS is being SAFED

TEST 3.2.1.5

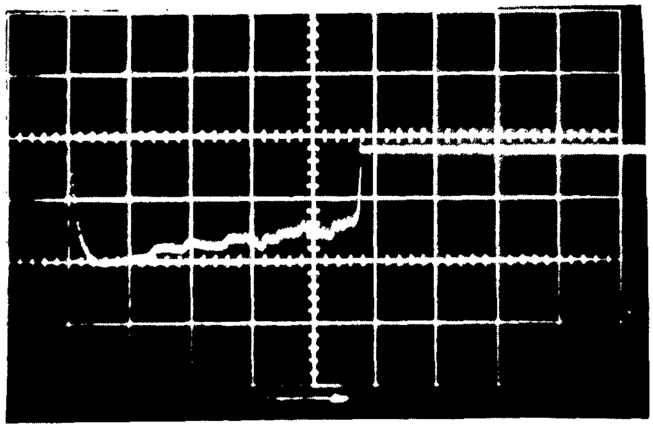


Photo #4 SCS CURRENT DURING ACTIVATION, SAFE TO ARM POSITION
Trace is voltage drop across a 50mv, 5 amp shunt, inserted in positive supply line. 5mx/cm, 10mv/cm
Note: Polarity is reversed

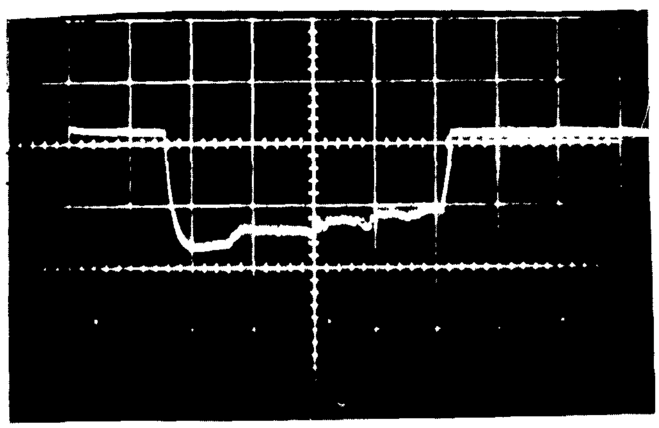


Photo #5 SCS CURRENT DURING ACTIVATION, ARM TO SAFE POSITION
Trace is voltage drop across a 50mv, 5 amp shunt, inserted in the positive supply line. 5ms/cm, 10mv/cm
Note: Polarity is reversed.

TEST 3.2.1.5

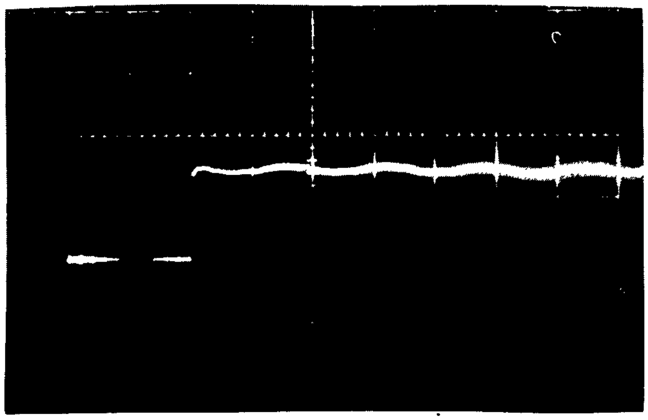


Photo #6 SCS ACTIVATION TIME, SAFE TO ARM POSITION
28 volts applied to J27-7, photographed J27-6
Triggered from J27-9, referenced to J07-17
10ms/cm, 20v/cm.

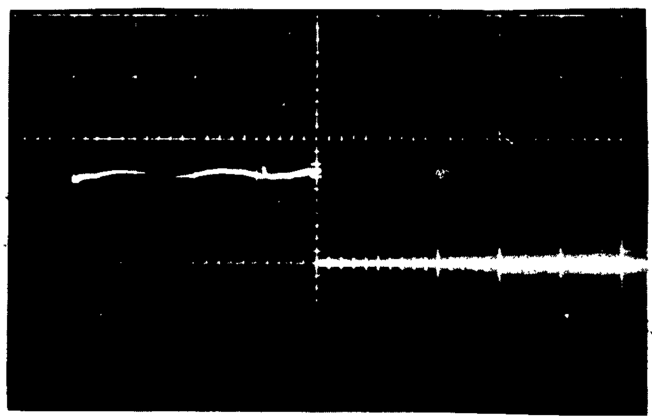
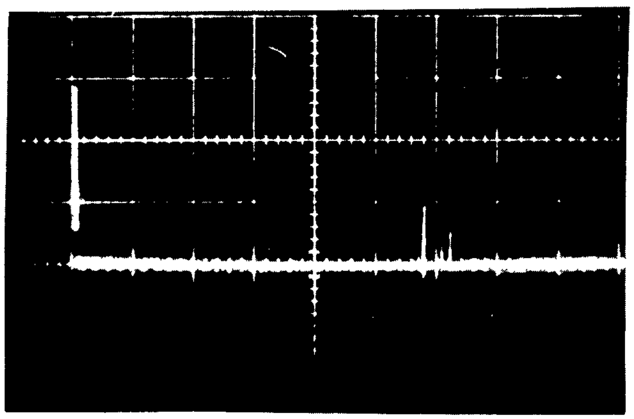


Photo #7 SCS ACTIVATION TIME, ARMED TO SAFE POSITION
28 volts applied to J27-7, photographed J27-6
Triggered from J27-9, referenced to J07-17
10ms/cm, 20v/cm

TEST 3.2.1.5



10 mv/cm

0.2 ms/cm

Photo #9 SCS Safed at the CCC

J27-9 monitored

J27-8 common

TEST REPORT 3.2.1.6

1. TITLE

LF Load Test, Repeater Telephone Set

2. OBJECTIVE

To determine the power requirements of the Repeater Telephone Set.

3. CONCLUSIONS

3.1 The Repeater Telephone Set has turn-on transients up to 7.75 amps.

3.2 Steady State Power is 46.8 watts, Steady State Current is .508 amps RMS.

3.3 The Repeater Telephone Set operates at a power factor between .807 and .828.

4. EQUIPMENT IN TEST

4.1 Repeater Telephone Set P/N 1274176-501 S/N 0000012

4.2 Digital Data Group P/N 8323616-505 S/N 0000005

5. TEST DESCRIPTION

5.1 The equipment was connected as shown in Figure 3.0.0.6-1, 3.2.1.6-1 and 3.2.1.6-2.

5.2 No load power, voltage, current, and transients were obtained through use of meters, scope, and recording oscillograph.

5.3 Power measurements were also taken, while

A. Ringing the wall phone

B. Ringing the LCF phone

6. SUMMARY OF TEST RESULTS

Steady State Input	No Phones Ringing	Wall Phone Ringing	LCF Phone Ringing	Voice Comm.
Voltage	114 VAC **	114 VAC	114 VAC	114 VAC
Current	.508 Amps * **	.540 Amps **	.511 Amps	.509 Amps
Power	46.8 Watts	51 Watts	47.1 Watts	47 Watts
Power Factor	.807	.828	.807	.809

* On transients obtained with NRA recording oscillograph. Photographs are attached.

** Photograph attached.

7. GENERAL INFORMATION

7.1 Test Engineer: Richard Mathias

7.2 Date Test completed: 4/24/63

7.3 Applicable E R's: None

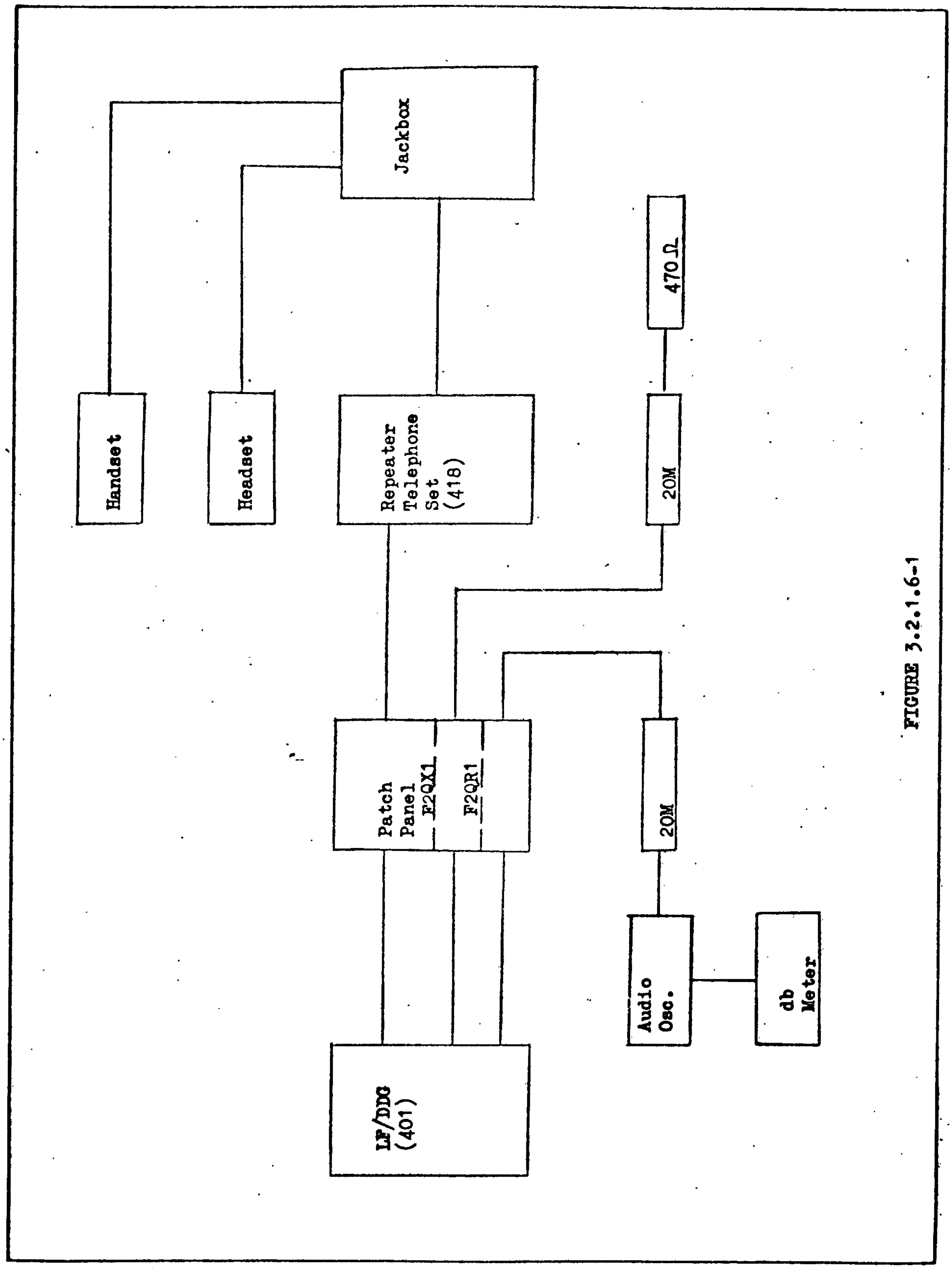


FIGURE 3.2.1.6-1

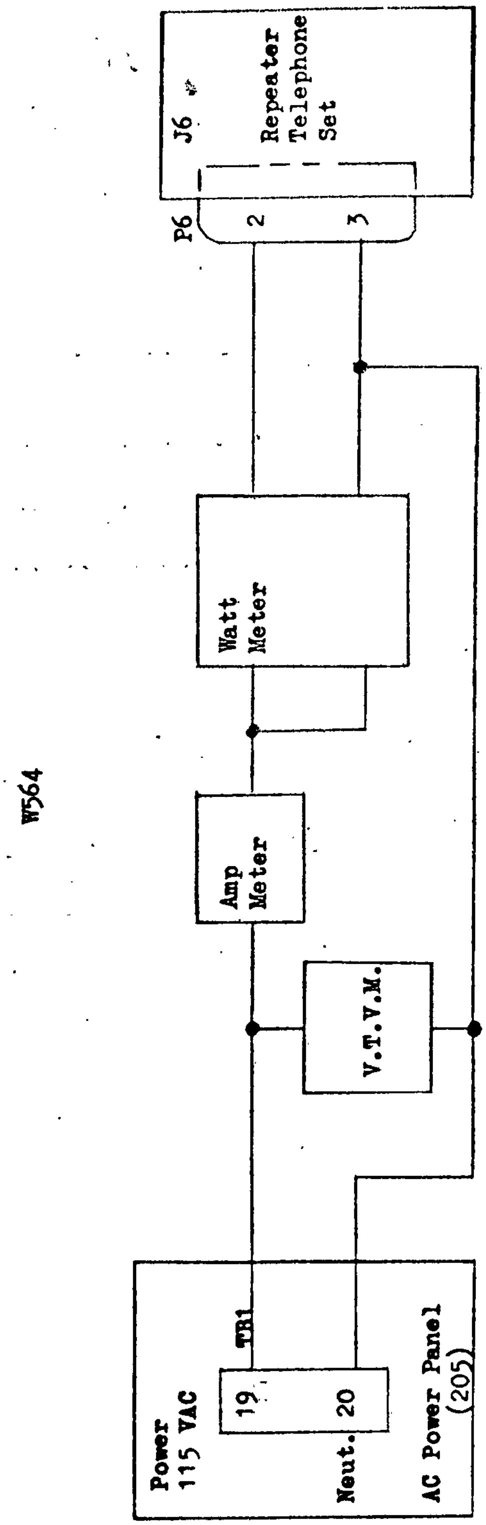
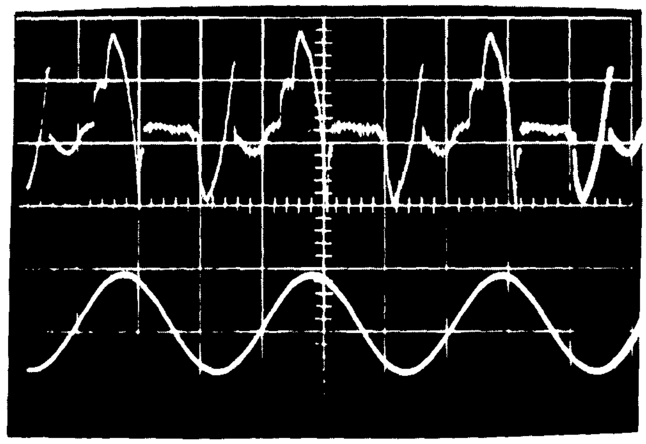


Figure 3.2.1.6-2

TEST 3.2.1.6



NO LOAD INPUT

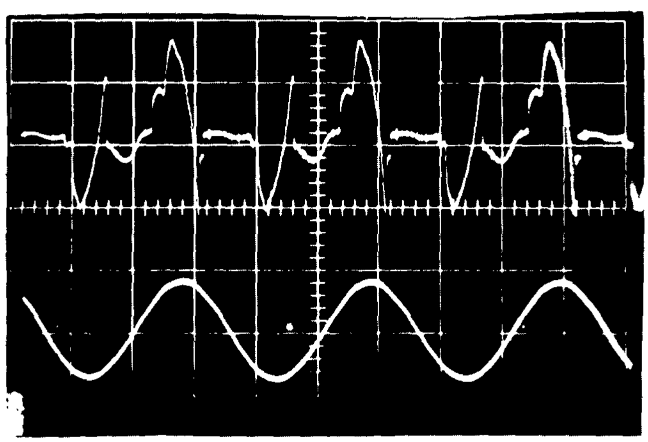
TOP

CURRENT
1 AMP/CM

BOTTOM

VOLTAGE
200 v/cm
5 ms/cm

Photo #1



INPUT WITH
WALL PHONE RING

TOP

CURRENT
1 AMP/CM

5 MS/CM

BOTTOM
VOLTAGE
200 v/cm
5 ms/cm

Photo # 2

TEST REPORT 3.2.1.7

1. TITLE

Volatile Decoder Load Test

2. OBJECTIVES

To determine the power requirements of the Volatile Decoder at the upper and lower voltage limits and to determine the voltage at which the code is dissipated.

3. CONCLUSIONS

3.1 For an input voltage of 32.2 volts to the Volatile Decoder, the input current was 68 ma. Case grids were simulated with two 600 ohm resistors.

3.2 The K1 tamper sensing relay energized at 18 volts. Once energized, the relay did not activate the volatization mechanism until the voltage was decreased to 3.1 volts.

4. EQUIPMENT IN TEST

4.1 Command Signals Decoder P/N 8325 136-502 S/N 0000004.

5. TEST DESCRIPTION

5.1 The equipment was connected per figure 3.2.1.7-1.

5.2 Code packs were not readily available, so the erase pin for the X-pack was monitored visually to determine volatization.

5.3 The ENGAGE CODE, SEAT X-PACK, AND SEAT Y-PACK knobs were pulled out.

5.4 The TRIP COCKING LEVER was pulled out, and the SEAT X-PACK knob was pushed in.

5. TEST DESCRIPTION (Con't)

5.5 The plunger which would normally engage the pedestal in the Decoder Case was pushed in and blocked in that position.

5.6 SEAT X-PACK and ENGAGE CODE plungers were pushed IN. A visual check was made to verify that the erase pin was retracted fully.

5.7 The voltage was increased from 0 to 32 volts.

5.8 At 32 volts, readings at voltage and current were made.

5.9 The voltage was then decreased to 0 volts while the erase pin was observed.

6. <u>TEST SUMMARY</u>

6.1 The test on the Volatile Decoder was performed with the drawer removed from the rack.

6.2 Case grids were simulated with 600 ohm resistors.

7. <u>GENERAL INFORMATION</u>

7.1 Test Engineer: Norman Noe

7.2 Test performed: 5/17/63

7.3 Applicable E R's: None

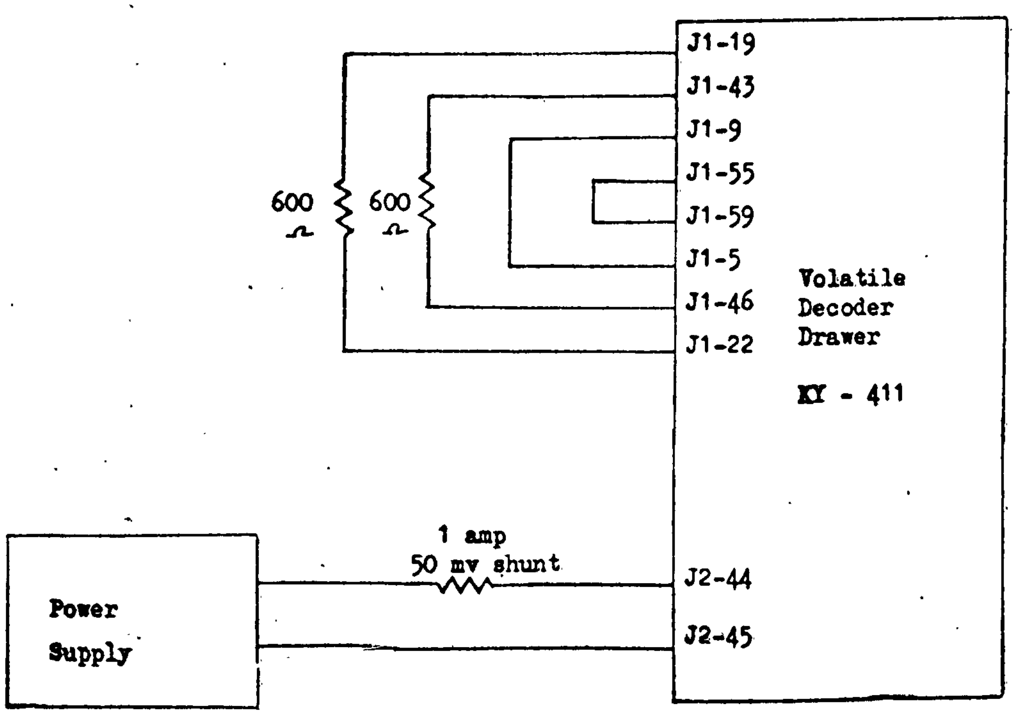


FIGURE 3.2.1.7-1

TEST REPORT 3.2.1.8

1. TITLE

VRSA Load Test

2. OBJECTIVES:

2.1 To determine the power requirements and load characteristics of the VRSA.

2.2 To examine the effects of low voltage on VRSA.

2.3 To investigate transients at the interface of VRSA

3. CONCLUSIONS:

3.1 The VRSA would not report faults properly with an input voltage of 24.0 volts on the Emergency Power input. At this voltage, only channel #2 was reported (Target Alpha). After readout of channel #2, VRSA stopped reporting. When interrogated again, Channel #2 repeated. Channel #40 was not reported either time. (Channel #40, VRSA Sign-off).

3.2 Several of the outputs and inputs to the VRSA contained a considerable amount of ripple and noise. Except for a noisy audio output, the ripple did not appear to be detrimental to VRSA operation.

3.3 Several transients were observed at the interface of VRSA during self test, reporting, and Remote Reset. These are shown in the oscillograph record samples included with this report. These transients did not affect the operation of the LF equipment.

4. EQUIPMENT IN TEST

4.1 VRSA , 10-21330/09628000-601A S/N P-3

4.2 Programmer Group, P/N 25-22036-89, S/N 0000034

4.3 LF/DDG, P/N 8323616-505, S/N0000005

4.4 LF/SMPG, P/N 8323617-504 , S/N 0000005

4.5 G & C Coupler, P/N 55 103-107 , S/N AHB0003

5. TEST DESCRIPTION

5.1 A special adaptor cable was installed between the VRSA and P/G to allow currents to be measured. Shunts were installed in the +28 volt supply line from the P/G, the +36 volt Emergency supply line, and in the 400 cycle monitor line.

5.2 The system was brought up to Strategic Alert.

5.3 Current to the VRSA was measured under the following conditions:

(a) No faults on VRSA, VRSA not reporting

(b) Faults set on channels 6-39, VRSA not reporting

(c) VRSA reporting

5.4 Ripple and noise at J3-97, J3-98, J3-10, J3-22, J3-21, and J3-96 were photographed before and after VRSA interrogation.

5.5 The points listed in table 3.2.1.8-1 were connected to instrumentation. The instrumentation was started.

5.6 Faults were set on VRSA using the self Test button and Fault selection switch. After readout, an SCN test was sent from the LCC. When SCN test was completed, the recorders were stopped.

5.7 Faults were set on channels #28 through #33 and VRSA interrogated. During readout, Channel #6 was set, using the Self test button

5. TEST DESCRIPTION 5.7 (Con't)

to verify that VRSA would switch to the higher priority fault.

5.8 Checks were made for transients on several points at the interface of VRSA, when the interrogate button was depressed, and when the self test buttons were depressed.

6. TEST SUMMARY

6.1 The maximum current drawn by VRSA from the Emergency Power supply (Batteries) was 1.37 amps. Maximum current from the 28 volt regulated P/G supply was 491 ma.

6.2 Results of Steady State measurements were as follows:

(a) VRSA not reporting, no faults

28V Regulated	27.92 volts	450 ma
36V Emergency	36.62 volts,	0 ma
400 cycle	121.53 volts,	87 ma

(b) VRSA not reporting, faults 6-39

28V Regulated	27.92 volts,	491 ma
36 V Emergency	36.58 volts,	43 ma
400 cycle	121.7 volts,	193 ma

(c) VRSA reporting, faults 6-39

28V Regulated	27.93 volts,	471 ma
36V Emergency	35.75 volts,	1.37 amp

(d) 400 cycle power off, P/G pwr off.

36 volt Emergency	36.010 volts	610 ma

(e) Ripple of Noise (referenced to 300 mcm ground bus)

VRSA not reporting

J3-97	1.6 volts p-p	every .46 ms

6. TEST SUMMARY (Con't) 6.2

J3-98	2.6 volts p-p	every .46 ms
J3-10	.56 volts p-p	every .42 ms
J3-96	1.5 volts p-p	415 cps
J3-21 & 22	.70 volts p-p	415 cps

(f) Ripple & Noise (referenced to 300 mcm ground bus VRSA reporting

J3-10	.5volts p-p	every .4 ms
J3-97	1.6 volts p-p	every .46 ms
J3-96	.70 volts p-p	irregular spacing
J3-21 & 22	10 volts p-p spikes every time motor reverses	

6.3 In response to the procedure of paragraph 5.7 of the test description, VRSA switched to a higher priority fault introduced during playback of a low priority fault.

7. GENERAL INFORMATION

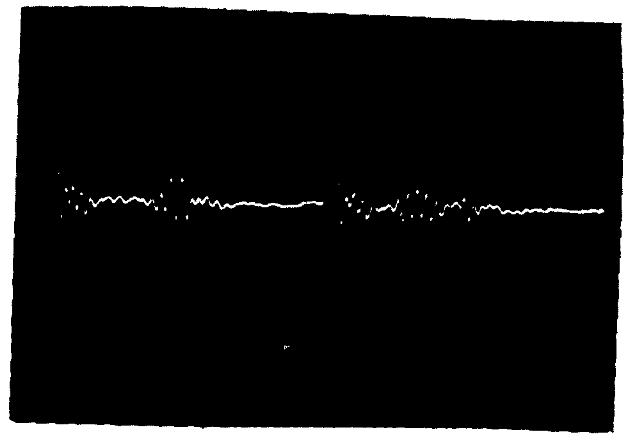
7.1 Test Engineer: Norman Noe

7.2 Date test completed: 3/21/63

7.3 Applicable E R's:

U178482	U178477
U178484	U178485
U178469	U14728
U039176	U147439
U039183	U147433
U178450	U147436
U178449	U147423
U178426	

TEST 7.2.1.8

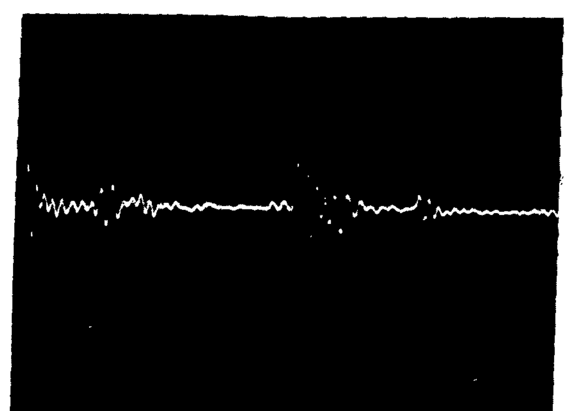


1 volt/cm

0.1 ms/cm

Photo #1 VRSA not reporting

J3-97 referenced to 300 mcm bus



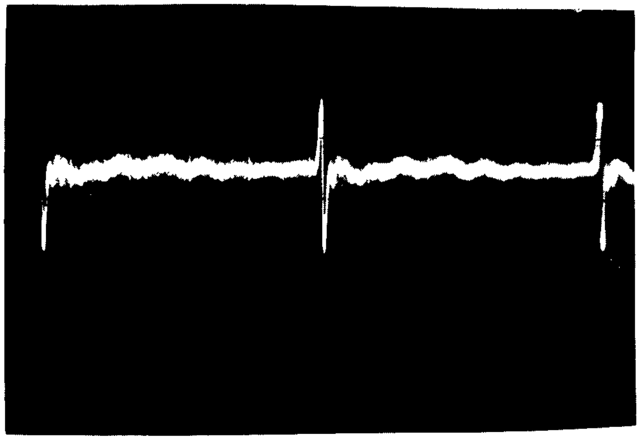
1 volt/cm

0.1 ms/cm

Photo #2 VRSA reporting

J3-97 referenced to 300 mcm bus

TEST 3.2.1.8

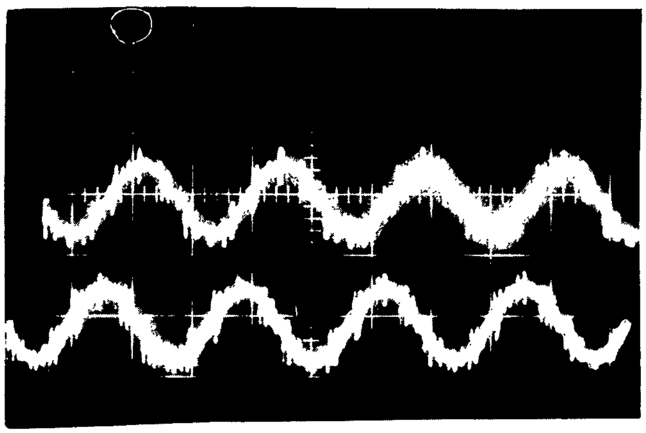


1 volt/cm

0.1 ms/cm

Photo #3 VRSA not reporting

J3-98 referenced to 300 mcm bus



J3-21 on Channel A

0.5 volt/cm

1 ms/cm

J3-22 on Channel B

0.5 volt/cm

1 ms/cm

Photo #4 VRSA not reporting

J3-21, 22 referenced to 300 mcm bus

TEST 3.2.1.8

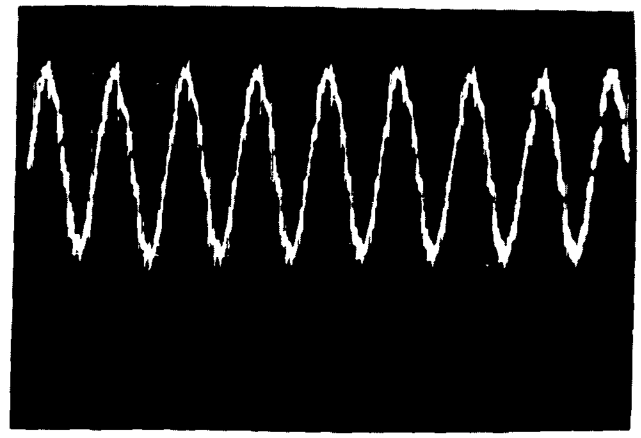


Photo #5 Ripple and noise, J3-96. Interrogate button OUT
0.5 v/cm, 2 ms/cm. Referenced to structure gnd.

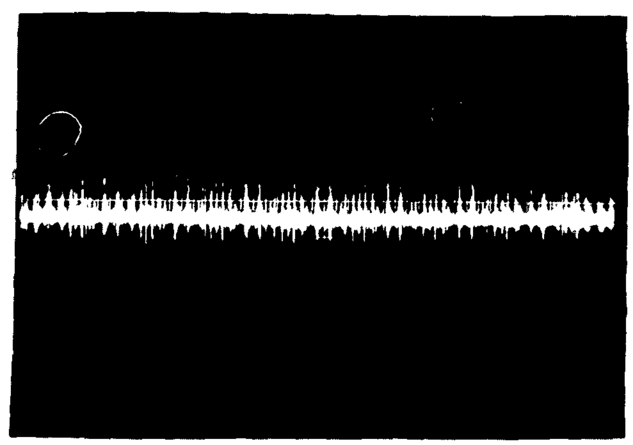
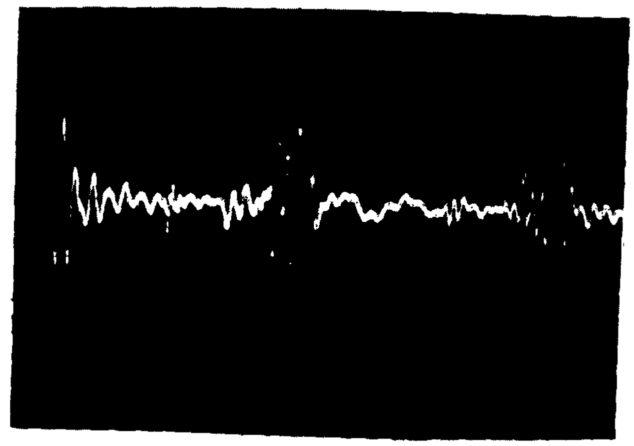


Photo #6 Ripple and noise, J3-96. Interrogate button IN
0.5 v/cm, 2 ms/cm. Referenced to structure gnd,

TEST 3.2.1.8

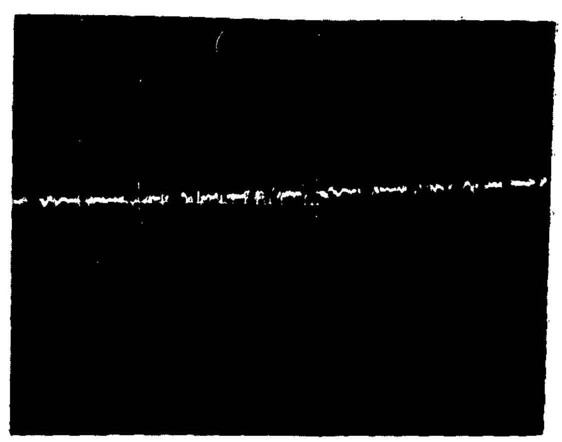


0.2 volt/cm

0.1 ms/cm

Photo #7 VRSA not reporting

J3-10 referenced to 300 mcm bus



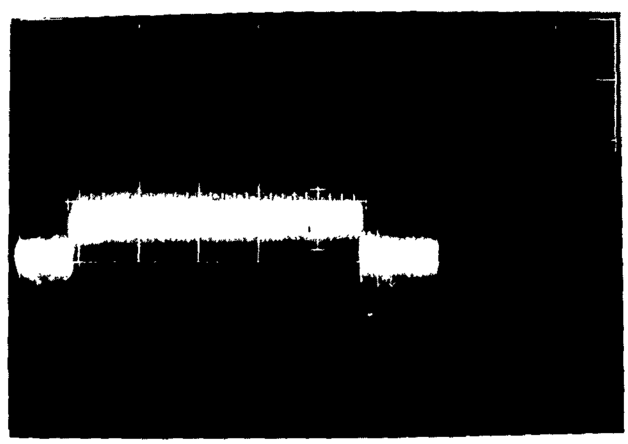
0.5 volt/cm

0.5 ms/cm

Photo #8 VRSA reporting

J3-10 referenced to 300 mcm bus

TEST 3.2.1.8

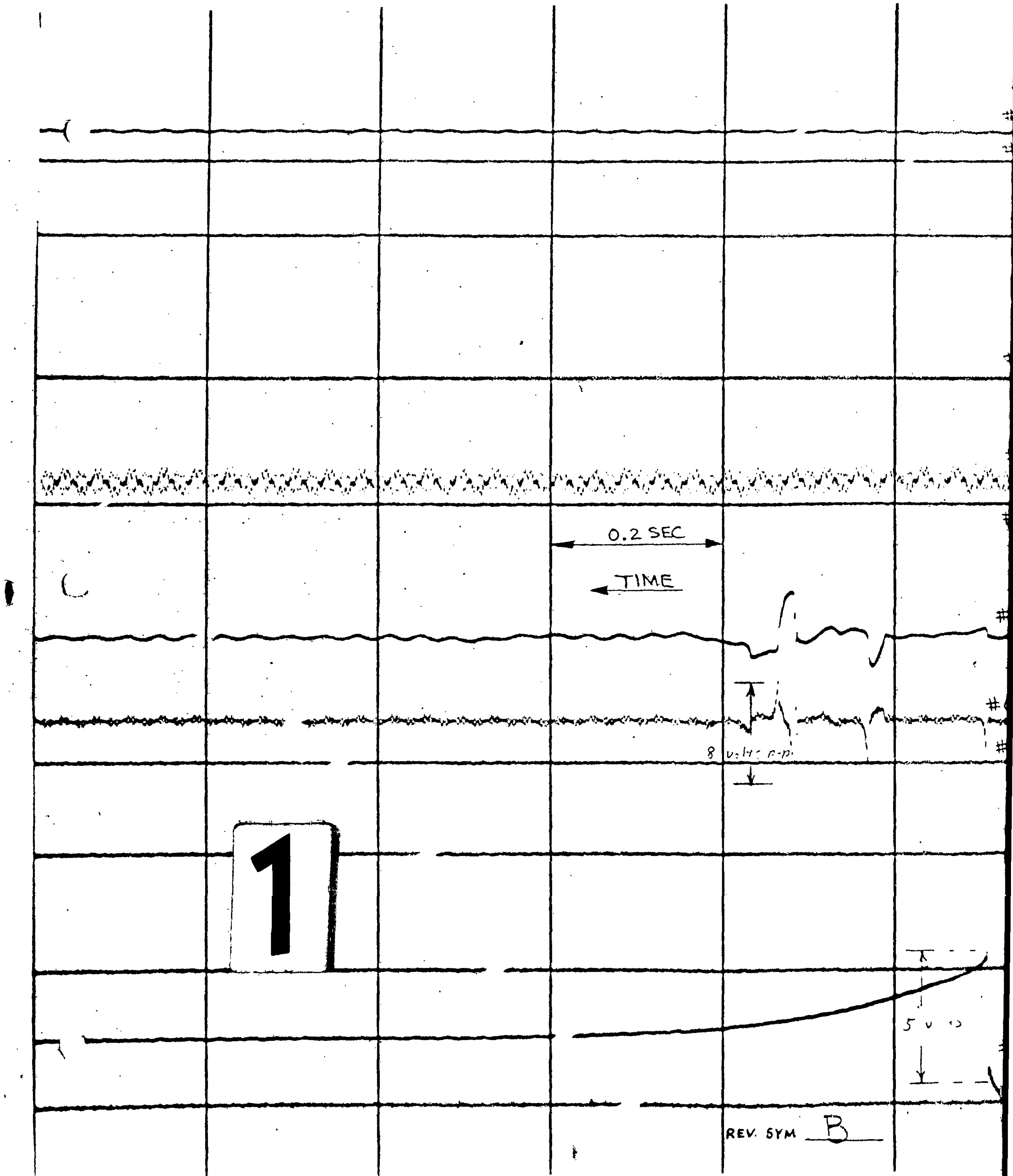


0.5 volt/cm

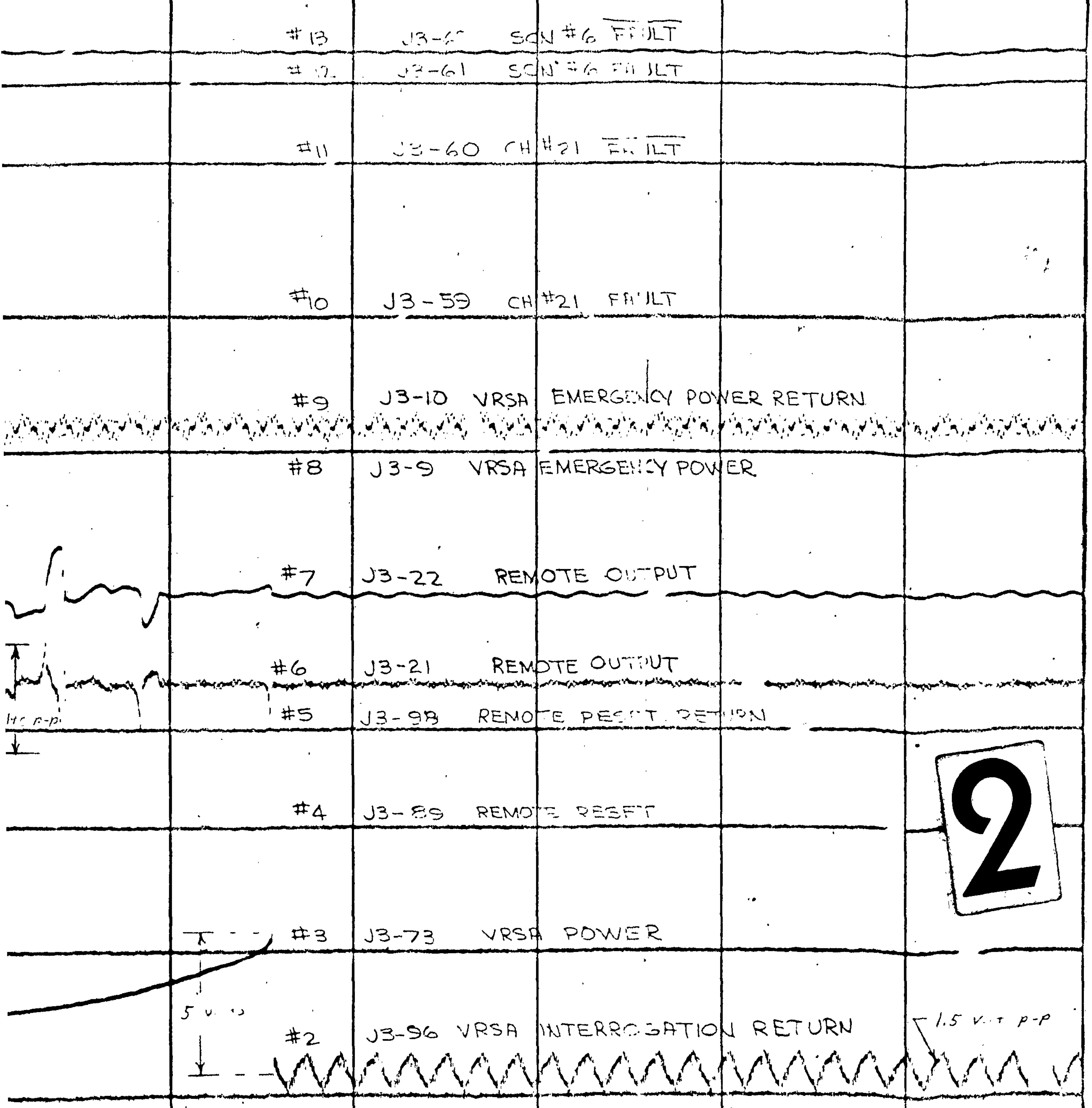
0.2 sec/cm

Photo #9 VRSA Interrogate

J3-96 ref renced to 300 mcm bus


0.2 SEC
TIME
1
REV. SYM B

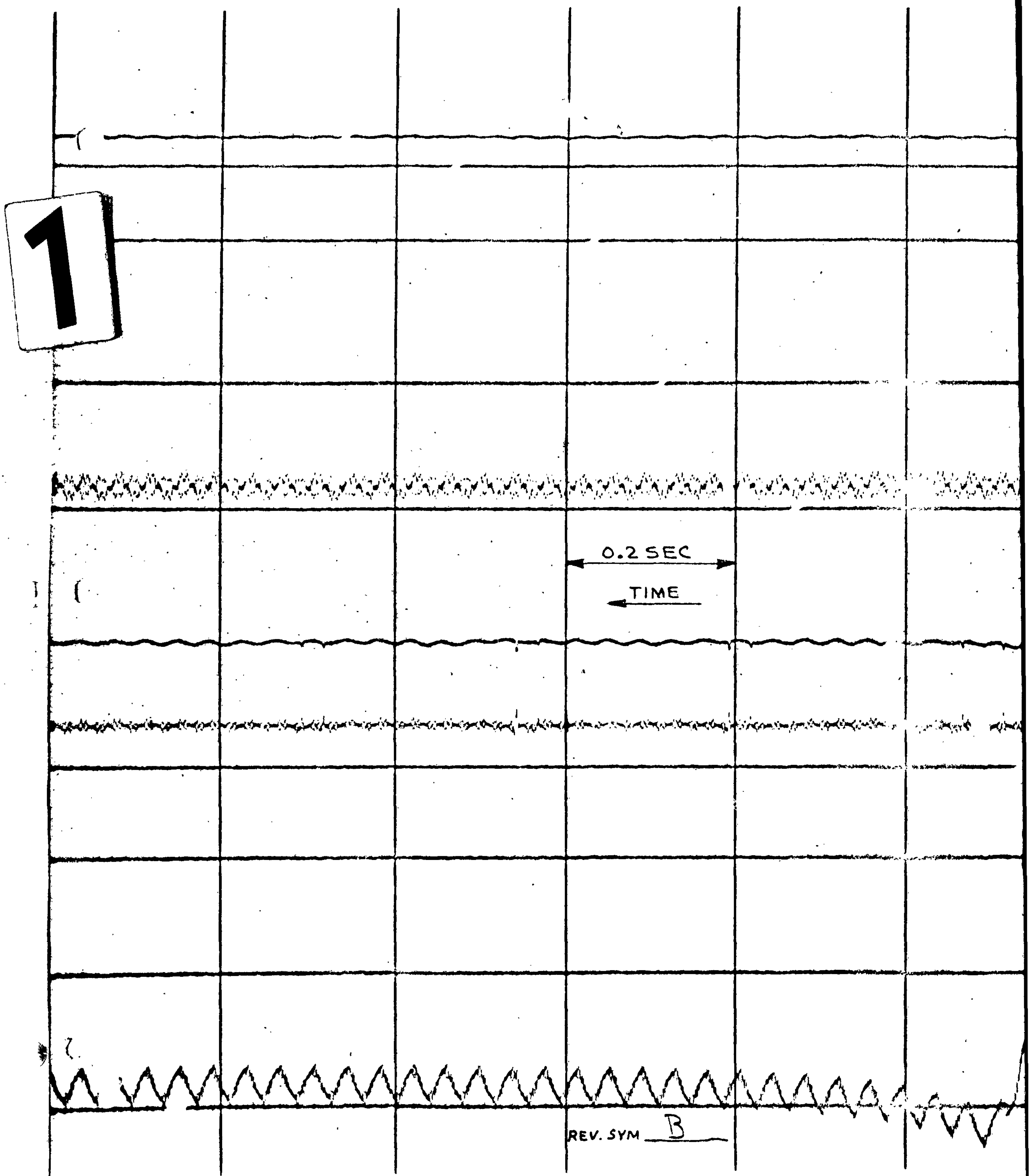
OSCILLOGRAPH 3.2.1.8-1
VRSA INTERROGATION
PULSE (CHANNEL 12)

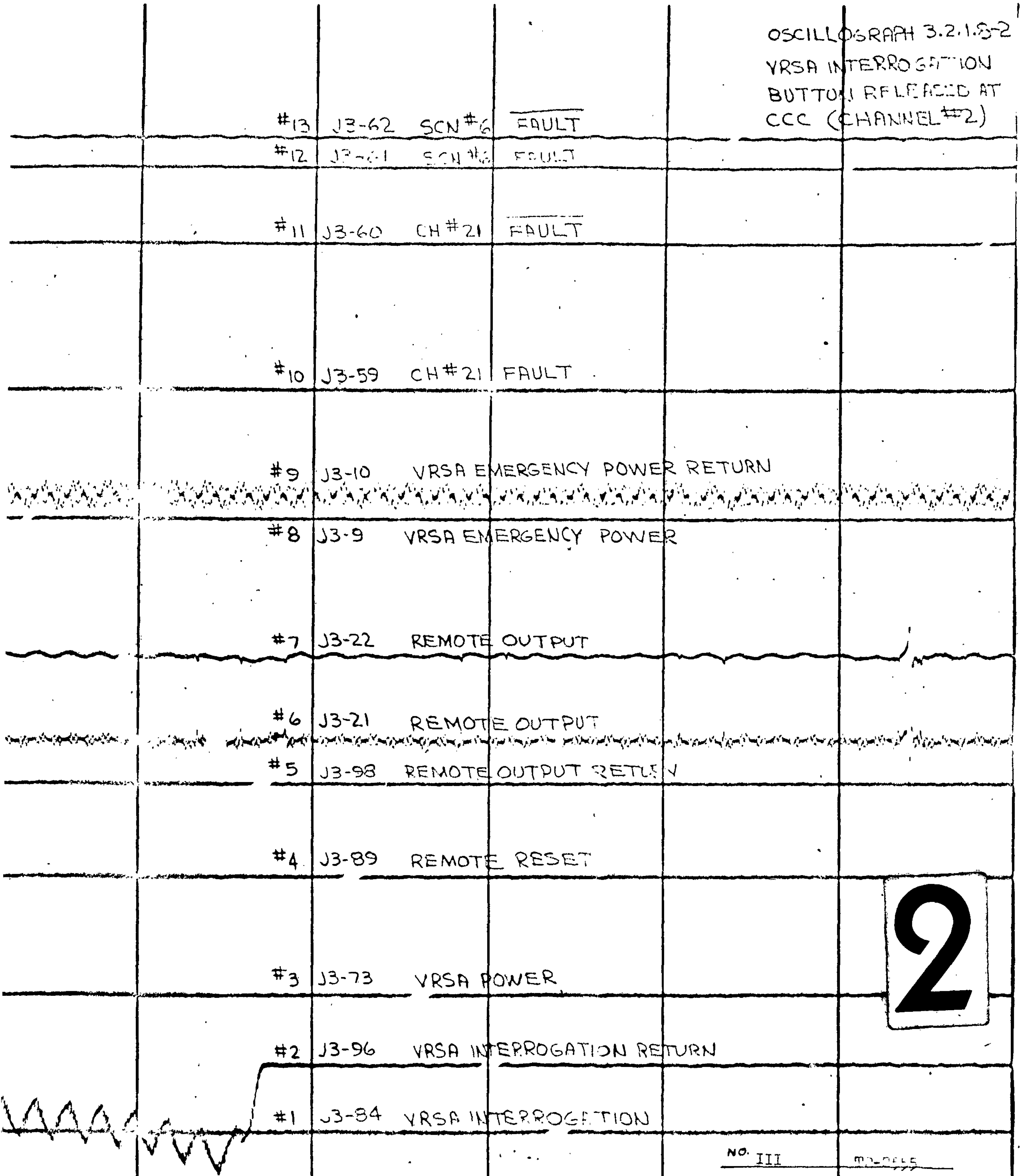


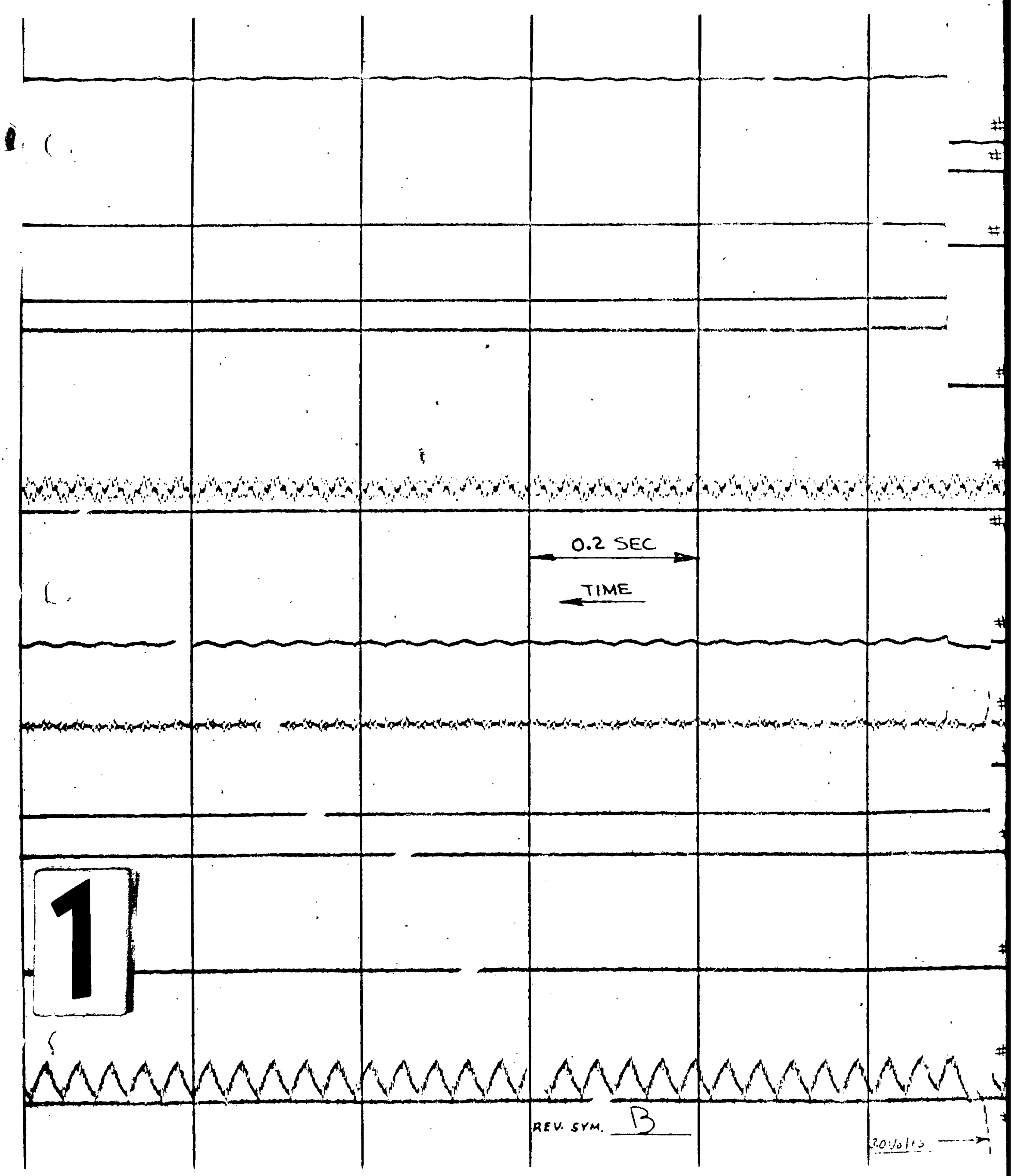
REV. SYM B

NO. III

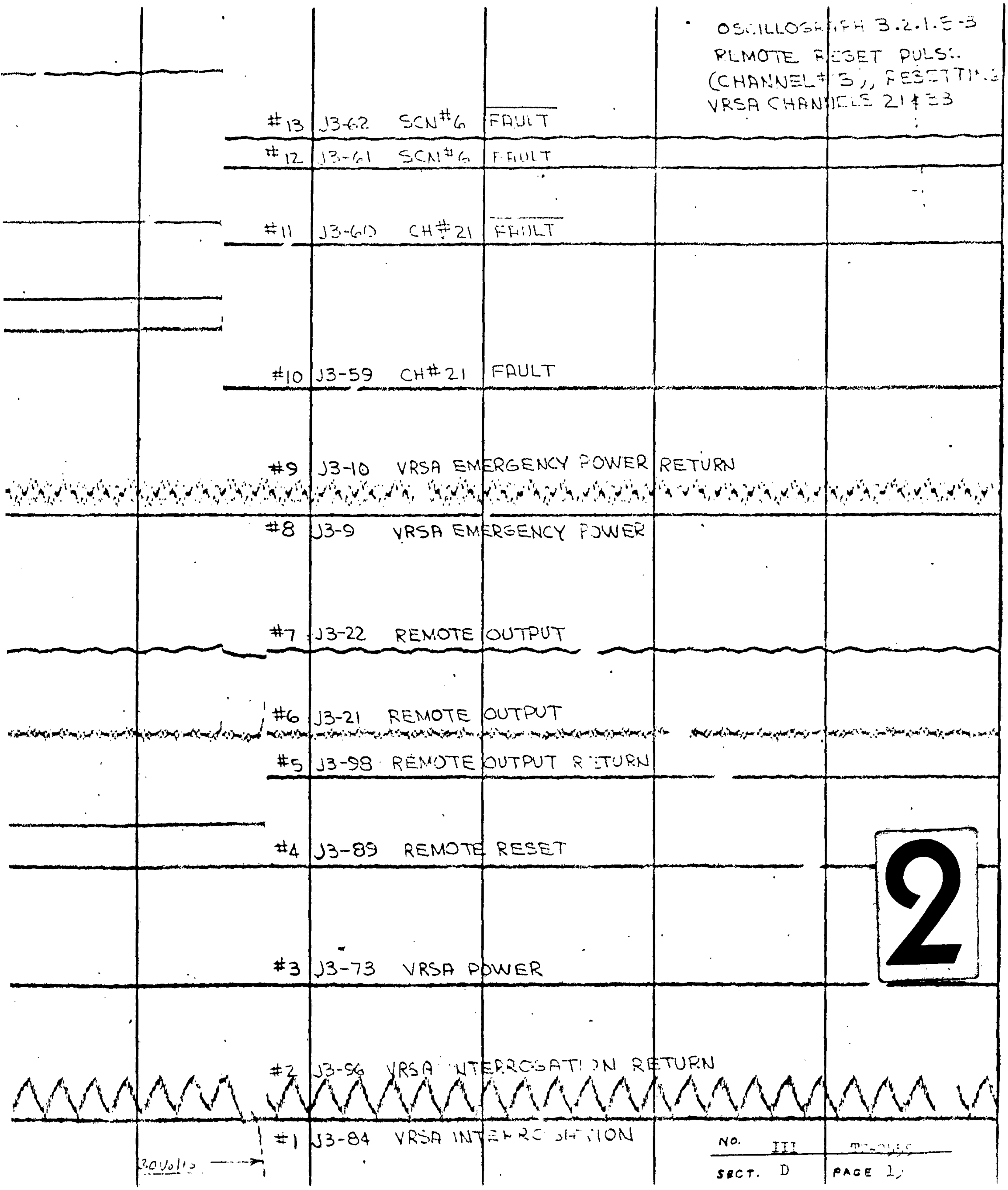
SECT. II PAGE

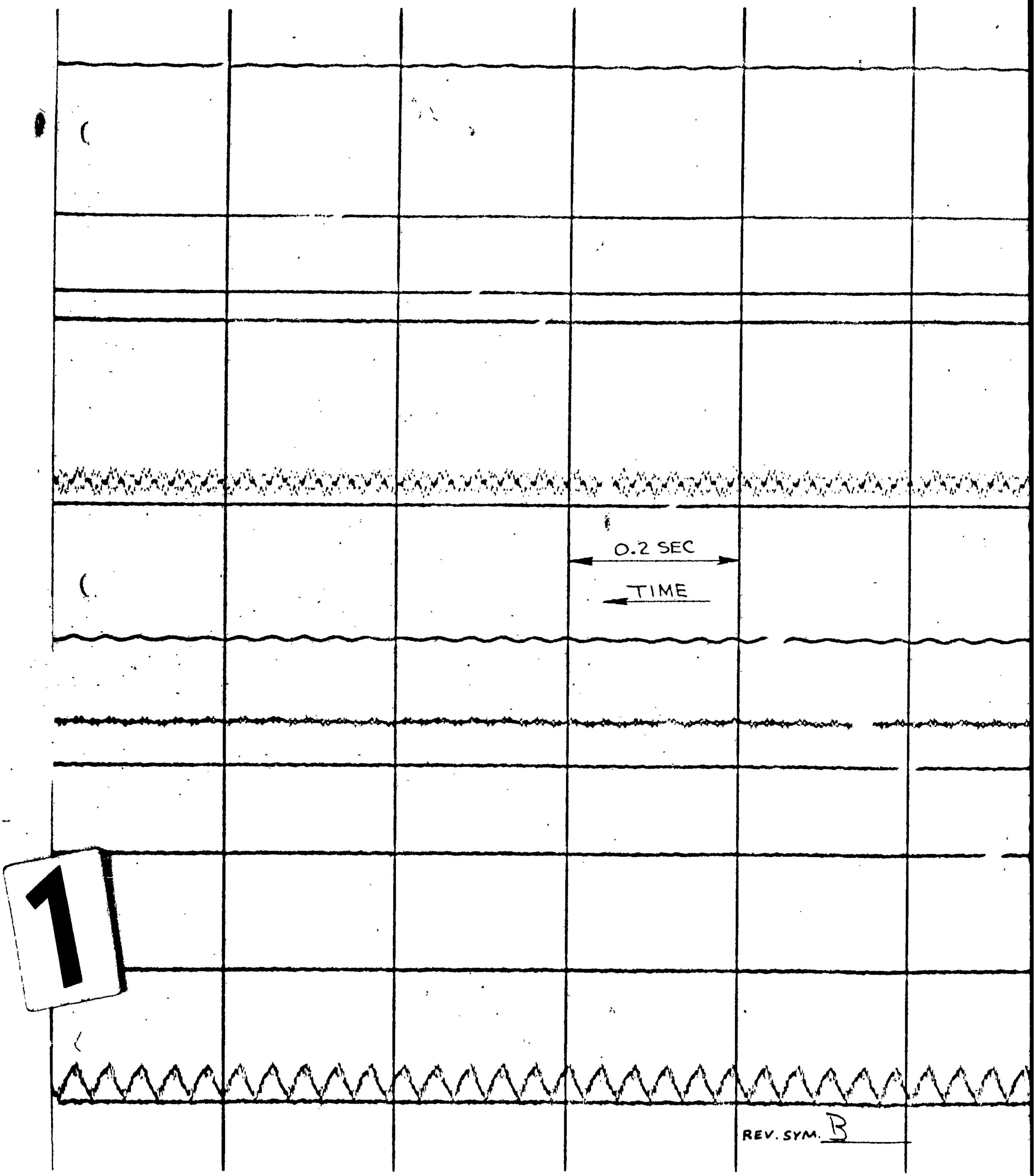

1
0.2 SEC
TIME
REV. SYM B


OSCILLOGRAPH 3.2.1.8-2
VRSA INTERROGATION
BUTTON RELEASED AT
CCC (CHANNEL #2)
#13 J3-62 SCN #6 FAULT
#12 J3-61 SCN #6 FAULT
#11 J3-60 CH #21 FAULT
#10 J3-59 CH #21 FAULT
#9 J3-10 VRSA EMERGENCY POWER RETURN
#8 J3-9 VRSA EMERGENCY POWER
#7 J3-22 REMOTE OUTPUT
#6 J3-21 REMOTE OUTPUT
#5 J3-98 REMOTE OUTPUT RETURN
#4 J3-89 REMOTE RESET
#3 J3-73 VRSA POWER
#2 J3-96 VRSA INTERROGATION RETURN
#1 J3-84 VRSA INTERROGATION
2

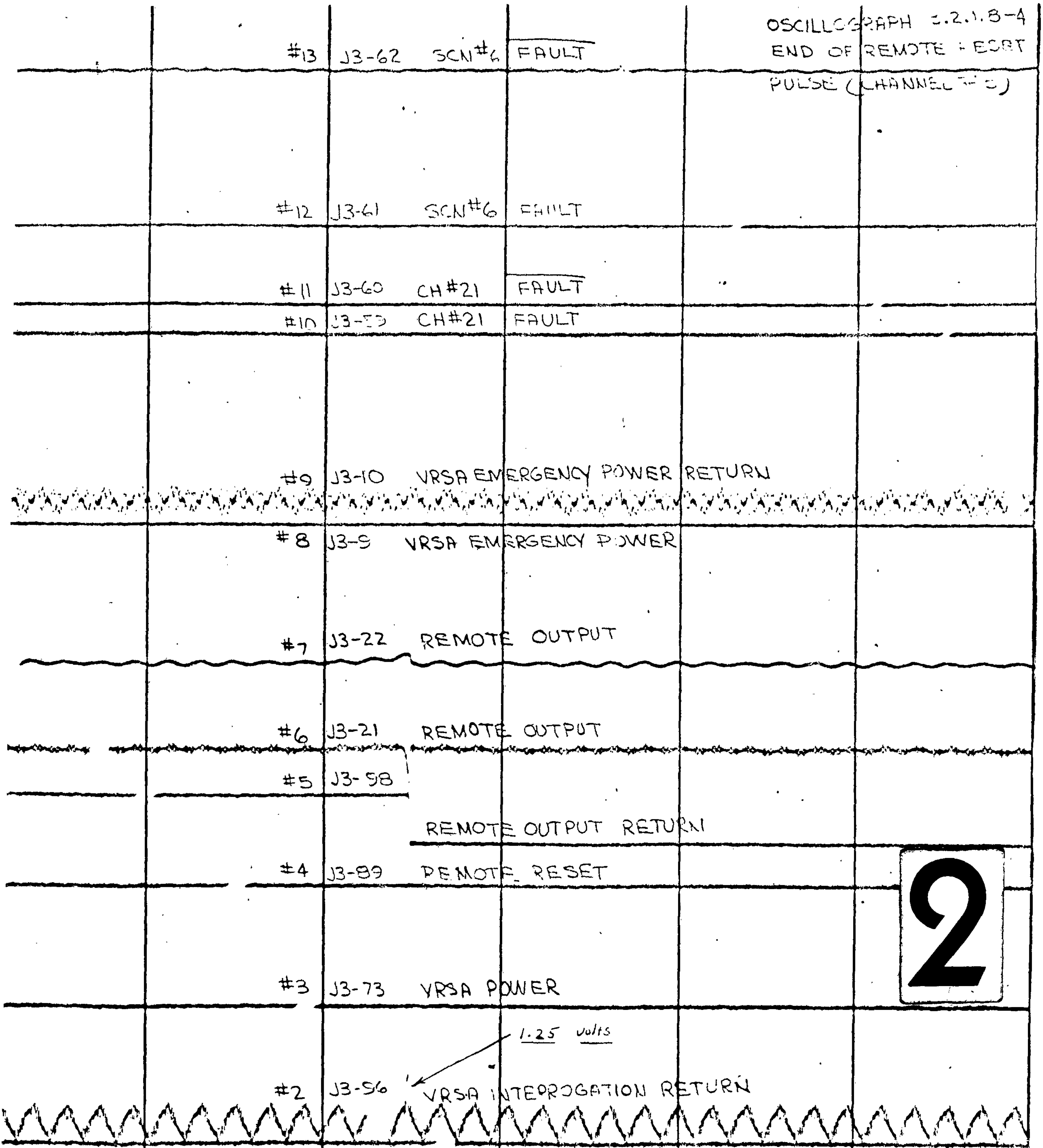

0.2 SEC
TIME
1
REV. SYM. B

OSCILLOGRAPH 3.2.1.E-3
REMOTE RESET PULSE
(CHANNEL #5), RESETTING
VRSA CHANNELS 21 & 33





0.2 SEC
TIME
REV. SYM. B
1



REV. SYM. B

NO. III TJ-0555

SECT. D PAGE 1

TEST REPORT 3.2.1.9

1. TITLE

LF Battery Charger Load Test

2. OBJECTIVES

2.1 To determine the power requirements of the LF 60 amp charger

2.2 To investigate the charging characteristics of the LF Batteries

3. CONCLUSIONS

3.1 The current surge at turn-on did not appear to be excessive. One current peak 60 amps above the loaded, steady-state current peaks was observed. Duration of the current surge was 4 ms (See photograph #5).

3.2 No current surges were observed on the output of the charger at turn-on. Output current stabilized in 160 ms.

3.3 The LF charger brought the LF Batteries from a fully discharged state (9volts) to 36.58 volts in 78.5 hours.

4. EQUIPMENT IN TEST

4.1 Battery Charger and Alarm Set, P/N 25-25561-44, S/N 0000004.

4.2 Batteries, P/N 10-20811-7, S/N's 0000001, 0000052, 0000051, 0000006, 0000009, 0000017, 0000008, 0000013, 0000016, 0000020, 0000010, 0000007.

5. TEST DESCRIPTION

5.1 The equipment was connected as shown in figure 3.2.1.9-1.

5.2 With the charger turned off, the LF batteries were discharged.

5. <u>TEST DESCRIPTION</u> (Cont'd)

5.3 The charger was turned on. Photographs were taken of input and output current transients.

5.4 The following measurements were taken every 15 minutes until the batteries reached full charge:

(a) Input Voltage

(b) Input Current

(c) Input Power

(d) Output Current

(e) Output Voltage

6. <u>TEST SUMMARY</u>

6.1 The LF Batteries were discharged by operating the LF M-G set on emergency power for approximately two days. The M-G set came to a complete stop and Battery Voltage reached 9 volts. The M-G set was turned off and the Batteries allowed to increase to 28 volts before the charger was turned on.

6.2 The charging curves for the LF Batteries are shown in Figure 3.2.1.9-2. The discontinuities in the curve are due to the charger being turned OFF and ON.

6.3 Pictures of turn-on transients and wave forms are included in this report.

7. GENERAL INFORMATION

7.1 Test Engineer: Norman Noe

7.2 Test Completed: 5/15/63

7.3 Applicable E R's: U147550

[illegible]: 5/01[illegible]

DATE: 5/11/63

Actual Time	Charging Time	Input Current	Inp[illegible]	[illegible]	Output Current	Out[illegible]	Actual Time	Charging [illegible]	Input Current	Inp[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12 [illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2	45	3.2	.62	76	[illegible]5	[illegible]	[illegible]	[illegible]	[illegible]
1[illegible] AM	3	48	3.2	.60	76	31.71				
11 45 AM	4:35	[illegible]	3.2	.59	76	31.74	10:[illegible] AM	1[illegible]	49.2	[illegible]5
12:15 PM	5:15	[illegible]	3.2	.59	7[illegible]	31.54	[illegible] AM	[illegible]	47.4	3.5
1:2[illegible] PM	[illegible]	48	3.3	.62	78	[illegible]	[illegible]	2[illegible]	47.2	3.4
[illegible]:10 PM	7	49	3.4	.64	7[illegible]	32.11	[illegible]	21	[illegible]	3.3[illegible]
3:1[illegible] PM	8	49	3.4	.61	76	32.2[illegible]	[illegible]	22	[illegible].2	3.[illegible]
4:10 PM	9	50	3.4	.57	78.[illegible]	32.34	[illegible] PM	[illegible]	[illegible]	[illegible]
5:10 PM	10	50.9	3.5	.61	78.6	32.45	4:[illegible] PM	24	[illegible]6	3.3
6:1[illegible] PM	11	51	3.5	.63	78.4	32.58	5:[illegible] PM	25	[illegible]	[illegible]
7:1[illegible] PM	12	50.2	3.5	.62	78.2	32.69	6:00 [illegible]	2[illegible]	[illegible]	3.24
8:10 PM	13	50.8	3.5	.61	78.4	32.80	7:[illegible]	[illegible]	[illegible]	3.24
9:10 PM	14	51.4	3.5	.61	77.8	32.92	8:[illegible] PM	[illegible]	[illegible]	[illegible]
10:10 PM	15	50.8	3.[illegible]	.60	77.2	33.0[illegible]	9:[illegible]	[illegible]	[illegible]	3.2[illegible]
11:10 PM	16	50.6	3.5	.61	77.2	33.[illegible]	10:[illegible]	[illegible]	[illegible]	3.24
							11:[illegible]	31	[illegible]	3.24
							12:[illegible] AM	32	45.2	3.24

1

DATA SH[illegible]

[illegible] 4011 2000

5/11/63						DATE: 5/12/63							DATE: 5	
[illegible]	Input Current	Input Power	Power Factor	Output Current	Output Voltage	Actual Time	Charging Time	Input Current	Input Power	Power Factor	Output Current	Output Voltage	Actual Time	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9:45 [illegible]	3[illegible]
[illegible]	[illegible]	[illegible]	.62	[illegible]	[illegible]	2:[illegible]	[illegible]	[illegible]	[illegible]	.64	[illegible]	[illegible]	[illegible]	[illegible]
						3:[illegible] AM	35	43.8	3.10	.62	64.6	35.1	11:45 [illegible]	[illegible]
5	49.2	3.5	.62	72.9	33.35	4:[illegible] AM	36	41.[illegible]	[illegible]	.64	[illegible]	35.114	12:45 PM	[illegible]
[illegible]	47.4	3.5	[illegible]	72.0	33.4[illegible]	5:[illegible]	37	39.5	2.96	.65	[illegible]	35.22	1:45 PM	4[illegible]
[illegible]	47.2	3.4	[illegible]	74.2	33.53	6:[illegible]	38	37.4	2.90	.65	57.2	35.31	2:45	4[illegible]
1	47.0	3.32	.62	73.5	33.62	[illegible]	39.75	34.4	2.72	.65	55.0	35.[illegible]	3:45	45
2	47.2	3.[illegible]	.63	72.6	33.7[illegible]								4:45	46
3	46.[illegible]	3.36	.66	72.4	33.81								5:45	47
[illegible]	41.6	3.36	.63	72.4	33.91								6:45	4[illegible]
5	45.[illegible]	[illegible]	.64	7[illegible]	3[illegible]								7:45	4[illegible]
[illegible]	[illegible]	3.24	.65	[illegible]	[illegible]								8:45	50
[illegible]	[illegible]	3.24	.64	[illegible]	34.[illegible]								9:45	51
[illegible]	[illegible]	3.24	.64	[illegible]	34.2[illegible]								10:45	52
[illegible]	4[illegible]	3.24	.64	59.[illegible]	34.3[illegible]								11:45	53
[illegible]	[illegible]	3.24	.64	63.5	34.46									
1	[illegible]	3.24	.64	67.2	34.59									
2	45.2	3.24	.64	[illegible]	34.65									

2

DATA SHEET

		DATE: 5/13/63							DATE: 5/14/63					
Output Current	Output Voltage	Actual Time	Charging Time	Input Current	Input Power	Power Factor	Output Current	Output Voltage	Actual Time	Charging Time	Input Current	Input Power	Power Factor	[illegible]
[illegible]	[illegible]	9:45 AM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10:00 AM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.495	[illegible]	[illegible]	[illegible]	[illegible]	.67	[illegible]	35.47	[illegible]	55	[illegible]	2.1	[illegible]	
64.6	35.1	11:45 AM	[illegible]	31.6	[illegible]	.66	[illegible]	35.53	12:00 PM	56	[illegible]	2.04	[illegible]	[illegible]
[illegible]	35.114	12:45 PM	[illegible]	[illegible]	2.3	.66	[illegible]	[illegible]	1:00 PM	57	[illegible]	2.04	[illegible]	[illegible]
[illegible]	35.22	1:45 PM	[illegible]	[illegible]	2.16	.65	[illegible]	[illegible]	2:00 PM	[illegible]	21.1	[illegible]	[illegible]	[illegible]
57.2	35.31	2:45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	35.74	3:00 PM	59	22.0	[illegible]	[illegible]	7
55.0	[illegible]	3:45	45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4:00 PM	60	19.7	1.82	[illegible]	[illegible]
		4:45	46	[illegible]	1.94	[illegible]	32.6	35.86	5:00 PM	61	19.8	[illegible]	[illegible]	5.
		5:45	47	25.0	[illegible]	[illegible]	29.3	35.93	6:00 PM	62	19.5	1.60	[illegible]	4.
		6:45	48	[illegible]	1.70	.60	27.6	[illegible]	7:00 PM	63	19.4	[illegible]	[illegible]	3.
		7:45	49	23.4	1.60	.59	25.2	36.04	8:00 PM	64	[illegible]	1.50	[illegible]	3.
		8:45	50	22.6	[illegible]	.57	[illegible]	36.09	9:00 PM	65	19.3	1.50	.62	3
		9:45	51	21.8	1.46	.59	21.2	[illegible]	[illegible]	66	19.9	1.50	.66	[illegible]
		10:45	52	21.4	1.40	.60	19.4	36.20	11:00 PM	67	19.0	1.40	.64	2
		11:45	53	[illegible]	1.30	.54	17.2	36.23						

5/14/63

DATE: 5/15/63

[illegible]	Input Current	Input Power	[illegible]	[illegible]	[illegible]	Actual Time	Charging Time	Input Current	[illegible]	[illegible]	Output Current	Output Voltage
[illegible]	[illegible]	2.20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.51	[illegible]	[illegible]
	[illegible]	2.1	[illegible]	[illegible]	36.41	[illegible]	61	[illegible]	1.6	.75	2.6	[illegible]
	21.5	2.04	.85	12.2	[illegible]	[illegible]	70	18.5	[illegible]	.7	2.9	[illegible]
	21.0	2.04	[illegible]	12.9	[illegible]	[illegible]	71	18.5	1.65	.74	2.3	[illegible]
	21.1	2.00	.8	9.5	36.52	[illegible]	72	19.1	1.60	.73	2.25	36.61
	22.0	2.02	.8	7.2	36.48	[illegible]	73	19.0	1.60	.73	2.25	[illegible]
	19.7	1.82	[illegible]	6.5	36.53	[illegible]	74	19.0	[illegible]	73	2.4	36.54
	19.8	1.60	.67	5.5	36.54	[illegible]	75	19.2	1.6	.72	2.1	36.55
	19.5	1.60	.7	4.4	36.53	[illegible]	76	19.5	[illegible]	.75	2.1	[illegible]
	19.4	1.52	[illegible]	3.5	36.54	[illegible]	77	19.7	1.60	.34	2.05	36.57
	19.0	1.52	.65	3.2	36.55	[illegible]	78	19.5	1.80	.35	2.25	36.52
	19.3	1.50	.62	3.4	36.60							
	19.9	1.50	.66	3.0	36.62							
	19.0	1.49	.64	2.9	36.65							

4

TABLE 3.2.1.9-1

REV B

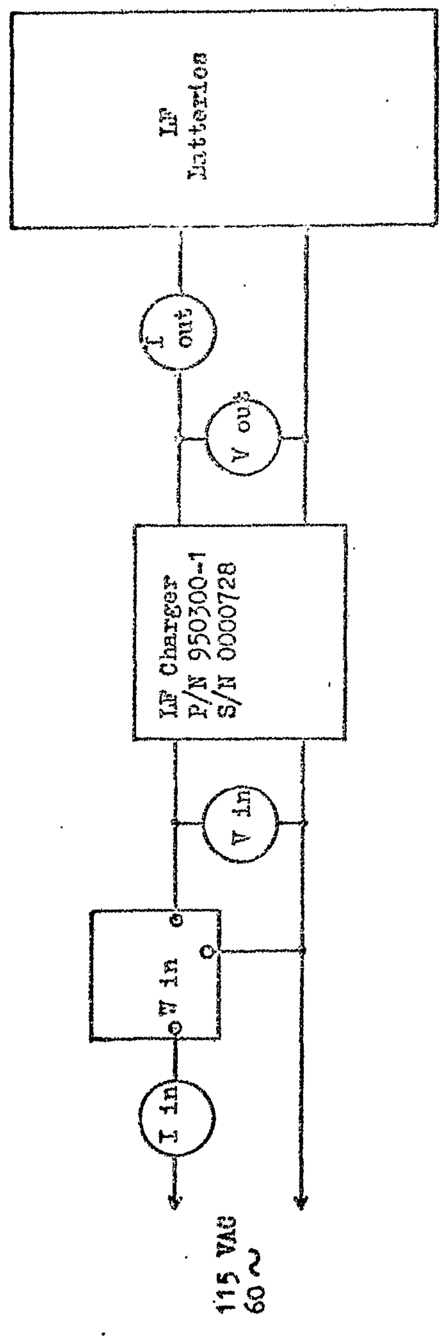


FIGURE 3.2.1.9-1

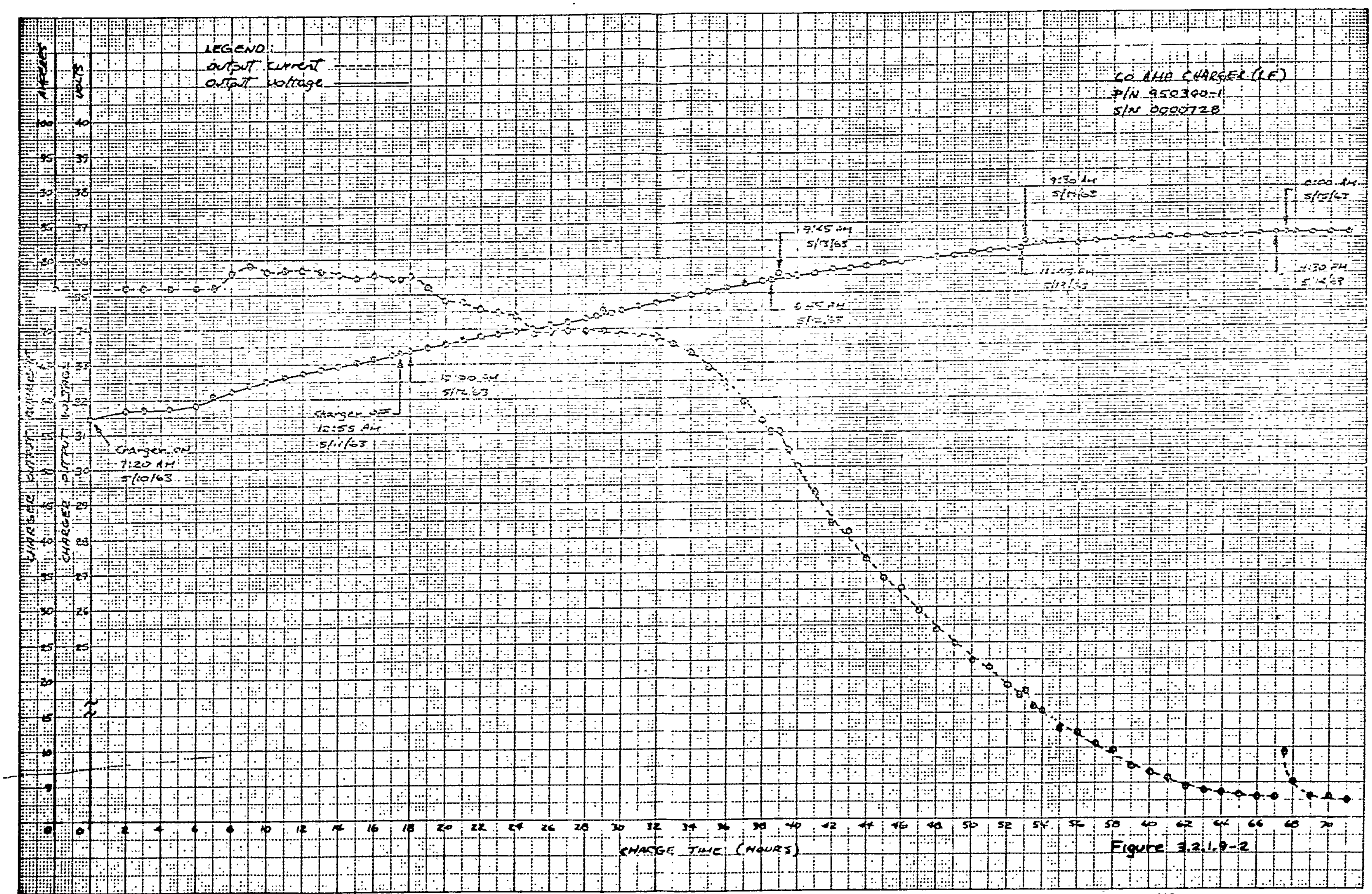


Figure 3.2.1.9-2

REV SYM B

TEST 3.2.1.9

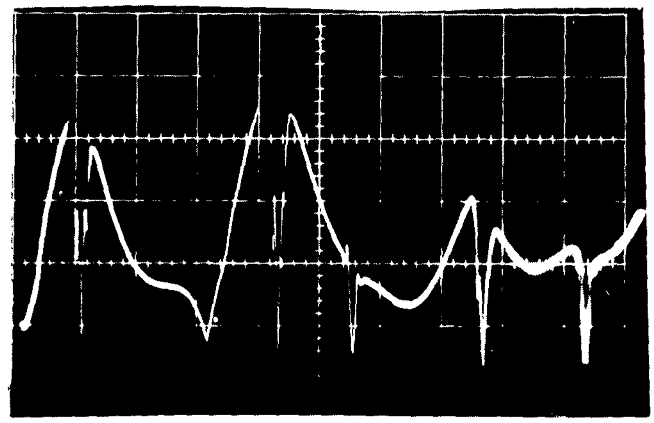


Photo #1 60 AMP CHARGER OUTPUT VOLTAGE AT TURN-ON
Output disconnected, voltage monitored at jacks on front of charger. 20 v/cm, 5 ms/cm.

Photo #2 60 AMP CHARGER OUTPUT VOLTAGE, STEADY-STATE
Output disconnected. 20 v/cm, 5 ms/cm

TEST 3.2.1.9

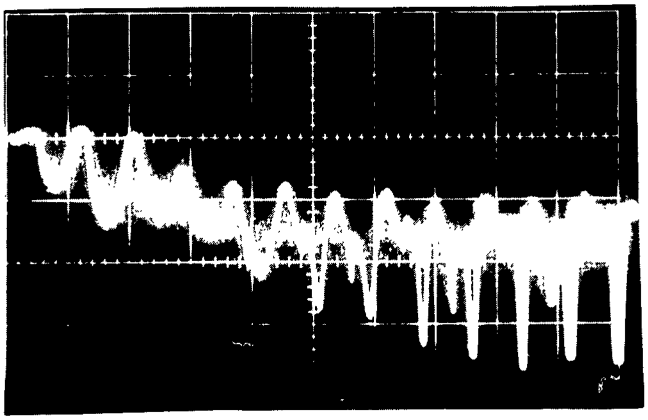


Photo #3 60 AMP CHARGER OUTPUT CURRENT TURN-ON TRANSIENT
Batteries discharged to less than 28 volts.
Trace is voltage drop across a 100 amp, 50 mv
standard shunt. 20 mv/cm, 20 ms/cm.

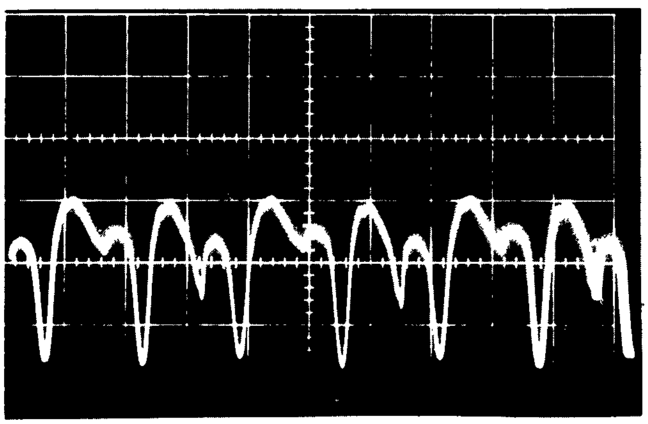


Photo #4 60 AMP CHARGER OUTPUT CURRENT WAVEFORM
Charger output current approximately 80 amps.
Trace is voltage drop across 100 amp shunt.
20 mv/cm, 10 ms/cm.

TEST 3.2.1.9

Photo #5 60 AMP CHARGER INPUT CURRENT TURN-ON TRANSIENT
Trace is voltage drop across a std. 100 amp shunt. 20 ms/cm, 50 mv/cm. AC coupling. Batteries under full charge.

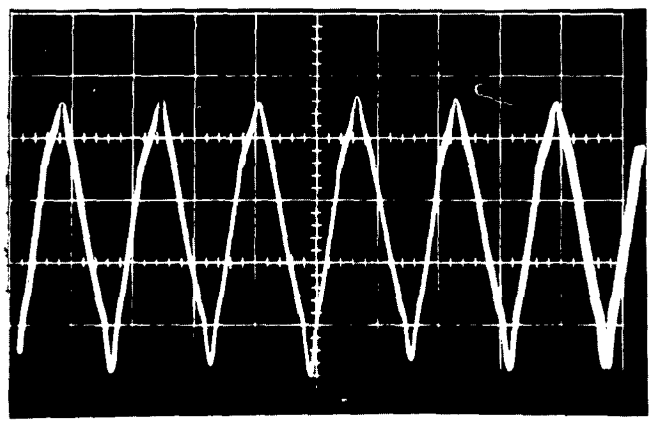


Photo #6 60 AMP CHARGER STEADY-STATE INPUR CURRENT (AC)
Standard 100 amp, 50 mv shunt. 20mv/cm, 10ms/cm
Batteries under full charge

TEST 3.2.1.9

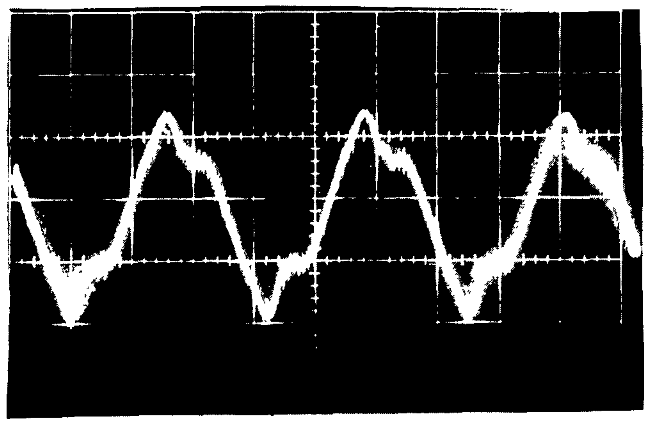


Photo #7 AC Input Current - Steady State

No load (Battery Charger disconnected)

10 mv/cm
1 msec/cm

TEST REPORT 3.2.3.1

1. TITLE

LF Operation During Transfer to Emergency Power

2. OBJECTIVES

To verify that the correct status will be transmitted by the LF/SCN during Transfer to Emergency Power.

3. CONCLUSIONS

3.1 The transmission of status by the LF/SCN was not affected by a transfer to Emergency Power, or by a transfer from Emergency Power to Primary Power. Oscillograph records of the transmitted diphase are included in the Test Summary.

4. EQUIPMENT IN TEST

4.1 Digital Data Group P/N 8323616-505, S/N 0000005.

4.2 Status - Command Message Processing Group P/N 8323617-503, S/N 0000005.

5. TEST DESCRIPTION

5.1 The equipment was connected per Figure 3.0.0.0-1. The following points were monitored using NRA Instrumentation:

Battery Voltage (+36 Volts)	P/G J4-7
LF/DDG +28 VDC Input	401 A7J2-A
LF/SCMPG +28 VDC Input	402 A7J2-A
LF Status Message - Diphase	F2ST
LF Transmit Message - Diphase	F2X1
P/G Timing +10 Volt Sq. Wave	P/G J2-4

5.1 (cont'd)

Output of Frequency Discremenater	
Primary Power Alarm	P/G J7-1
NCU Power	P/G J4-25
Long Time Counter	401 A6J1-u
Command Message	C2X1

5.2 The system was brought up to Strategic Alert per Test 3.2.2.2 of D2-13406, Vol. III.

5.3 A Test was commanded from the LCC. During the first 30 seconds of Test the primary power circuit breaker was opened and closed. The transmitted diphase was recorded during transfer.

5.4 Power transfers were performed while the system was performing a calibrate, SCNT, and a one vote Launch. In each case the transmitted diphase was recorded during transfer.

6. TEST SUMMARY

6.1 The frequency of the 400 cycle power was monitored during power transfer with a specially built Frequency Discriminator, SK-HDPU-22-20/1. No change in Frequency was observed on the Oscillograph records.

6.2 No distortion in waveform of the Diphase was observed on the oscillograph records.

6.3 Considerable contact bounce was observed when the Primary Power Alarm relay in the LF ~~M-6~~ Set closed. No effects upon Programmer Group on SCN Operation were observed, however.

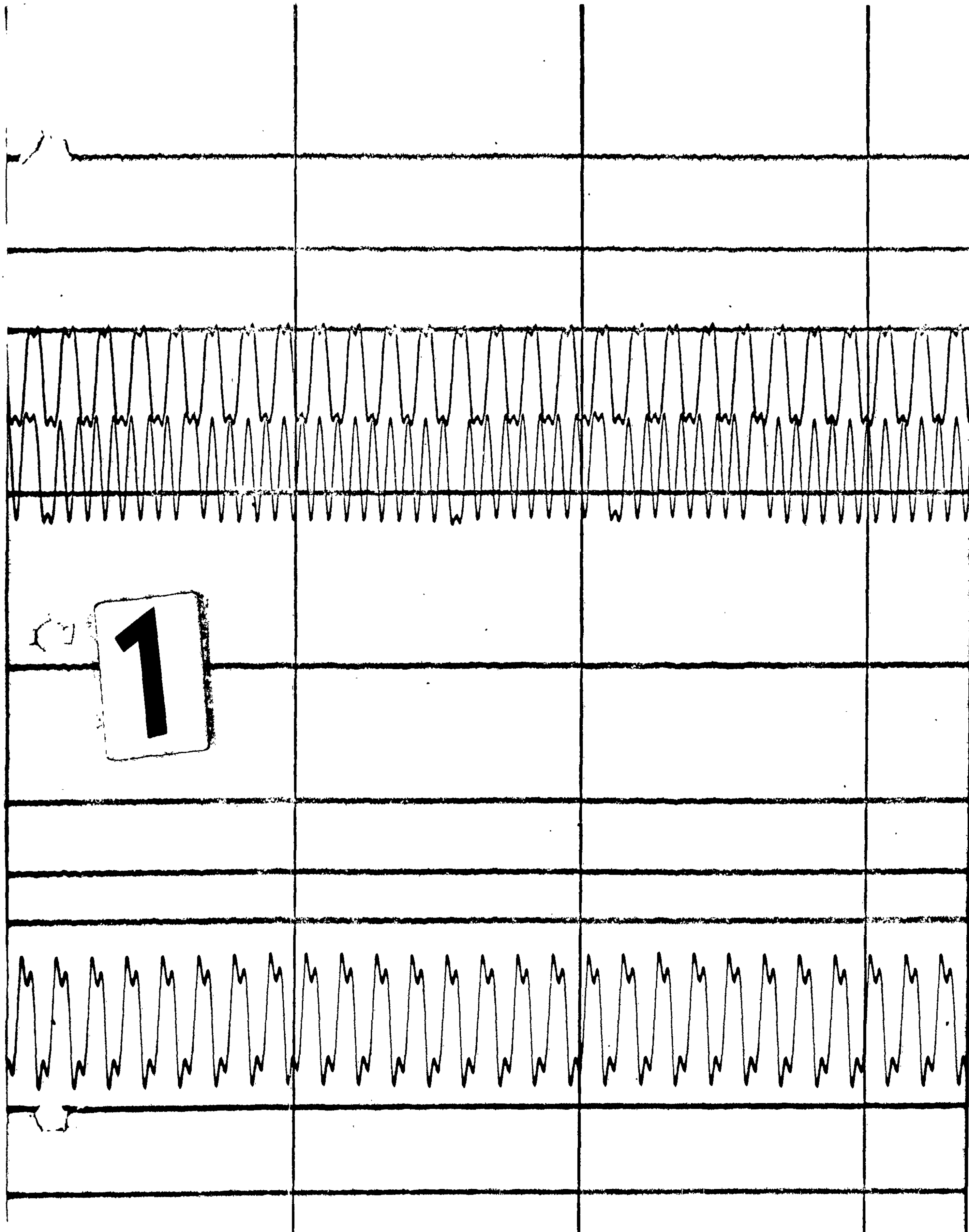
7. GENERAL INFORMATION

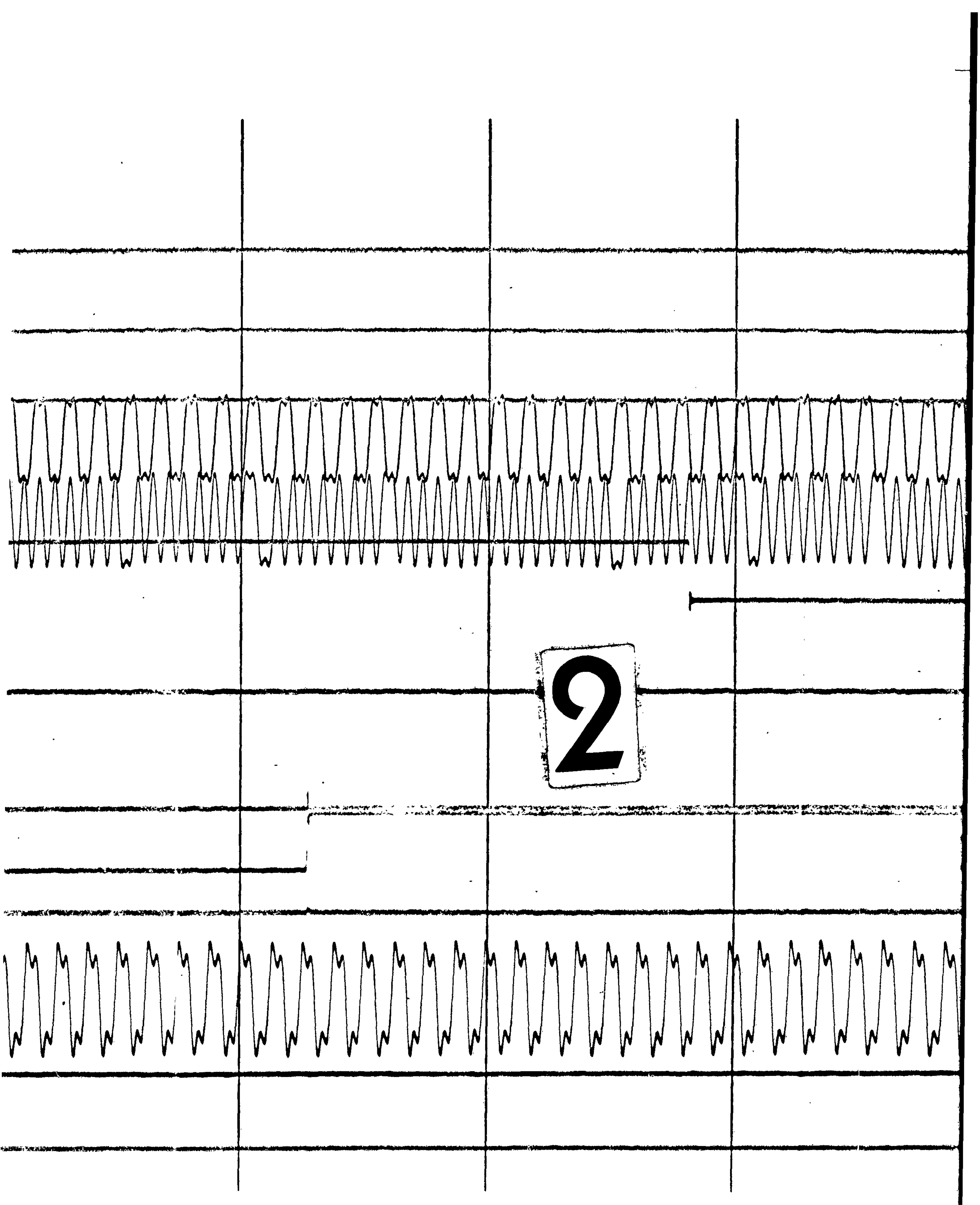
7.1 Test Engineer: Norman Noe

7.2 Date Test Completed: 3/14/63

7.3 Applicable ER's:

U178426	U039183
U178449	U039176
U178450	F443966
U150046	U150095


1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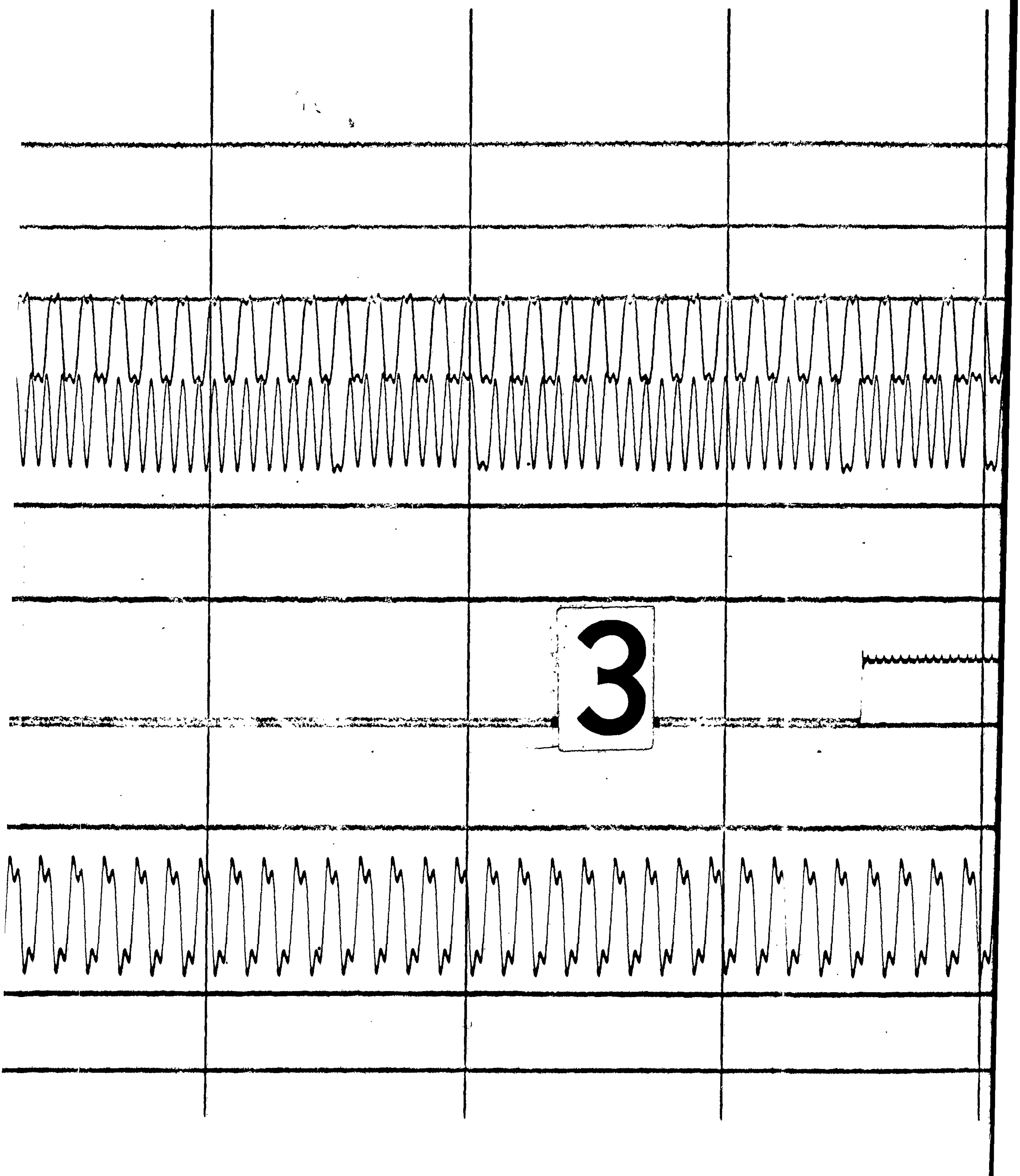
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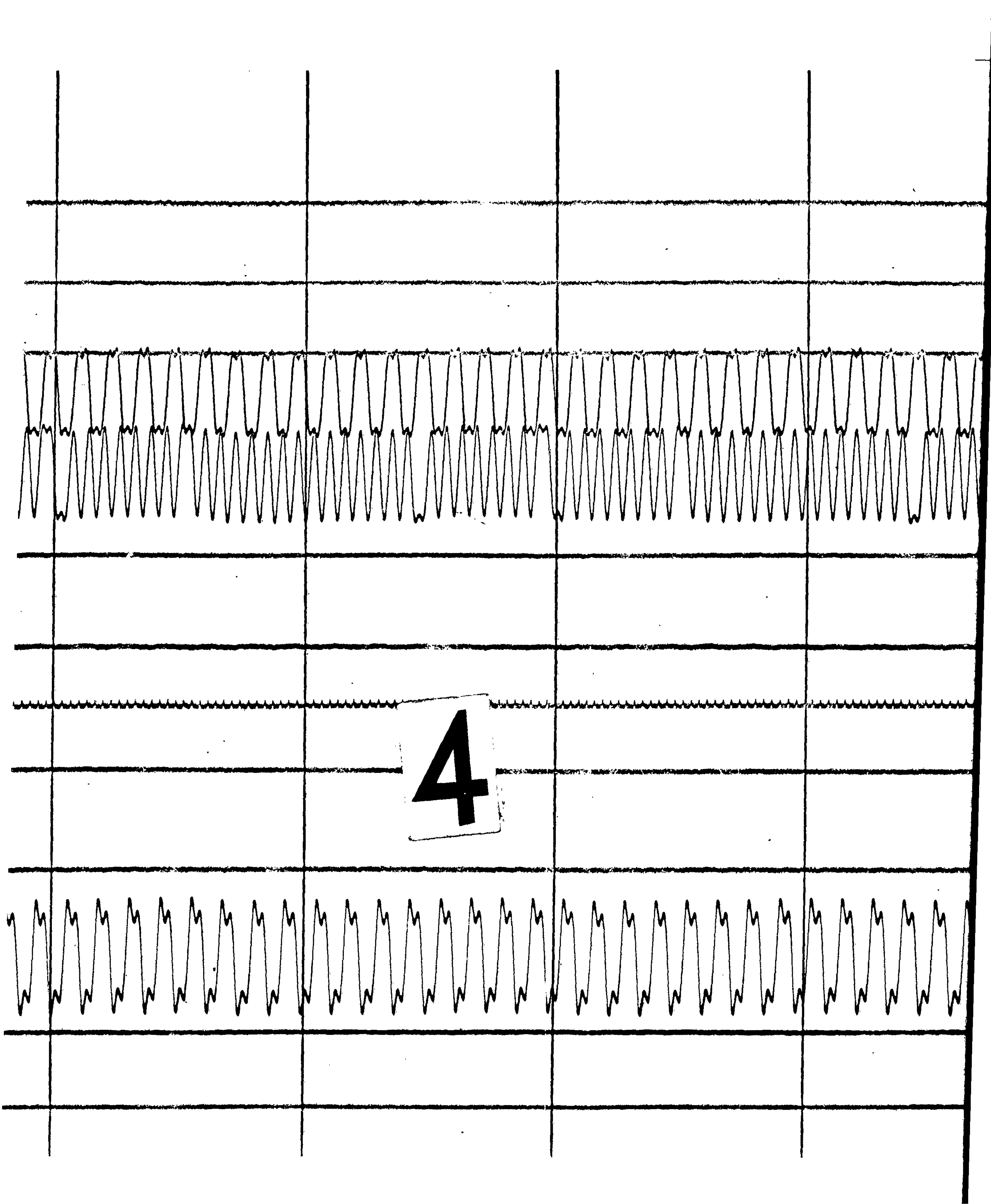
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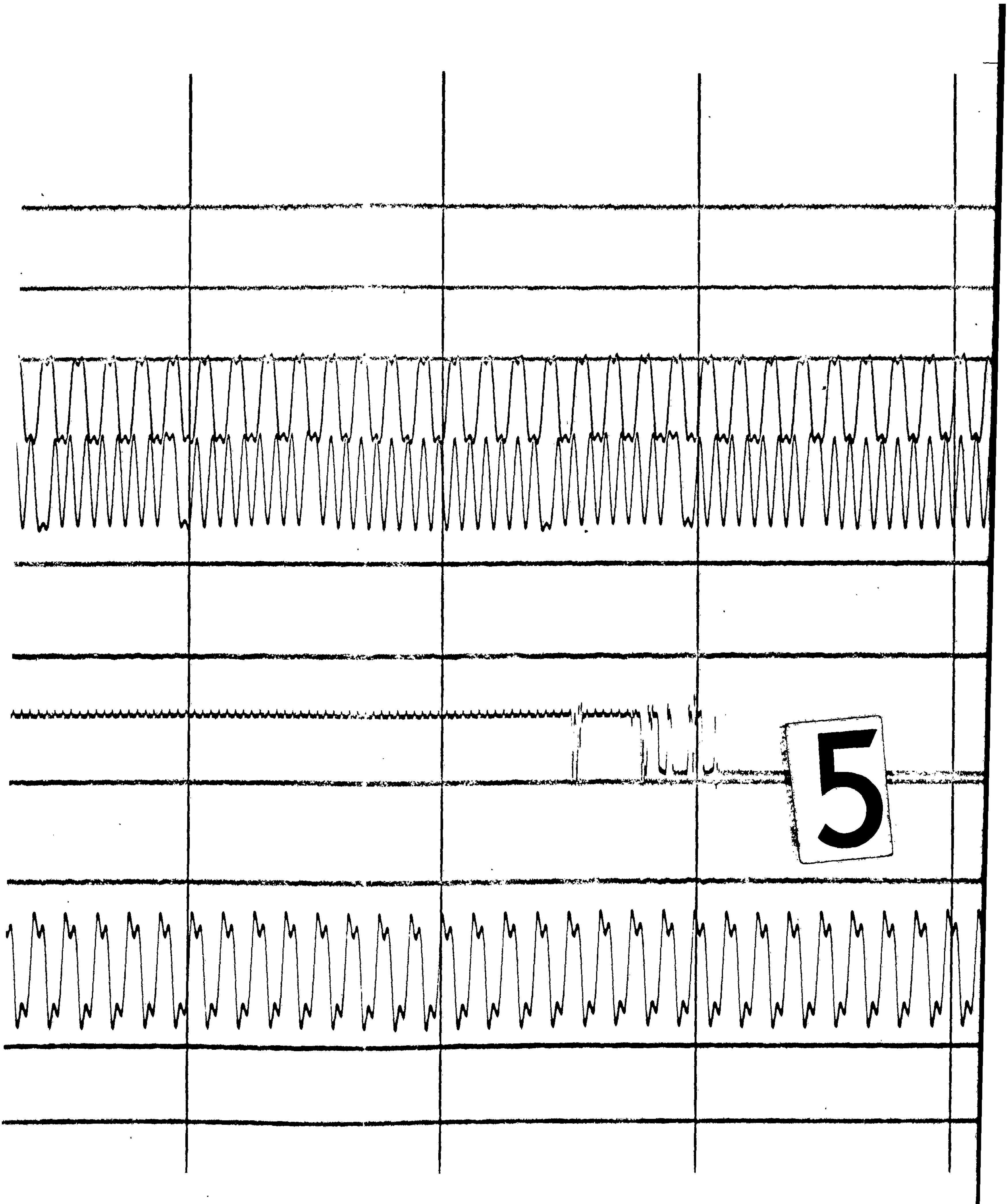
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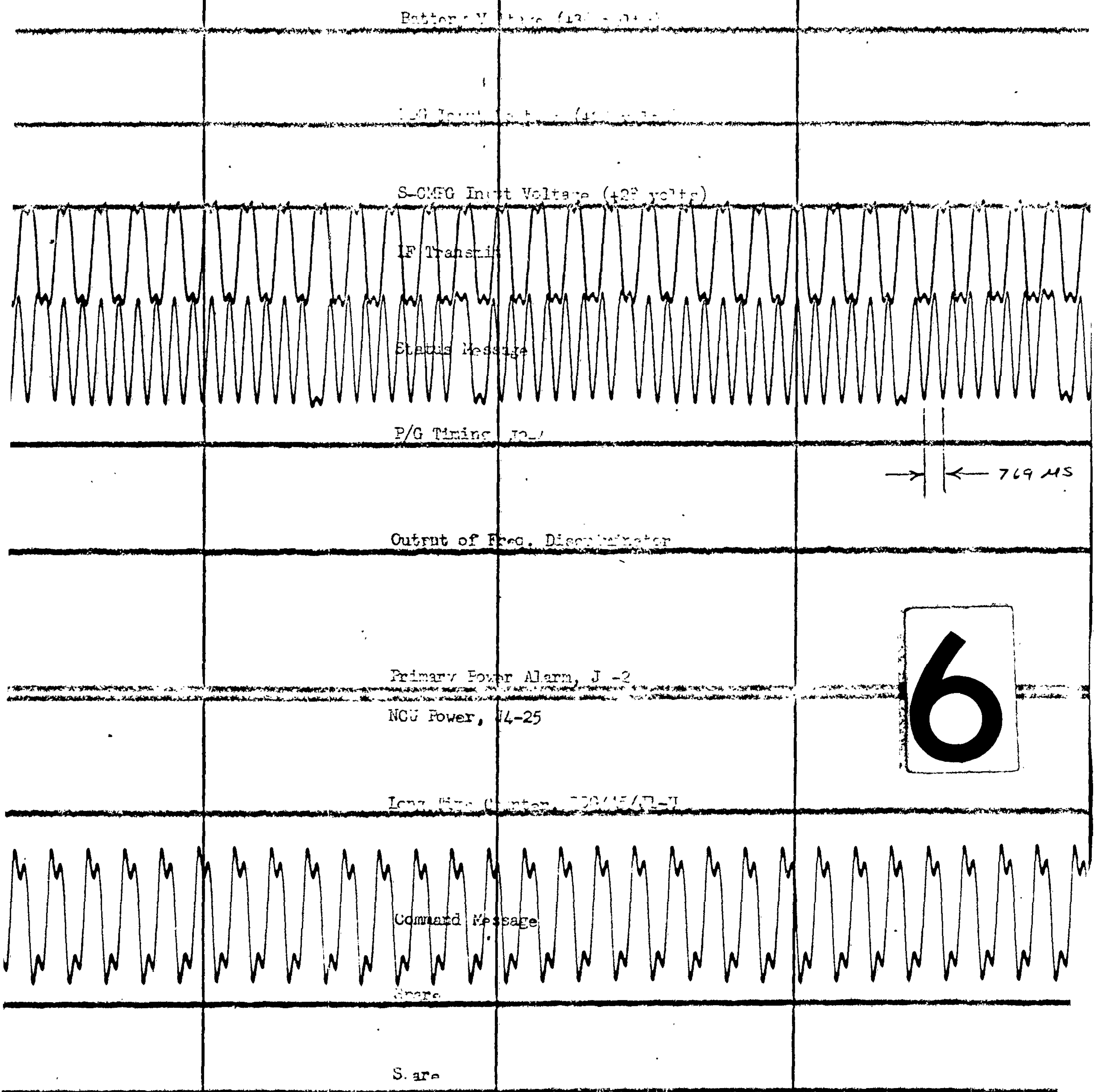
Oscillograph 3.2.3.1-1
Power transfer during
G&C portion of Test.



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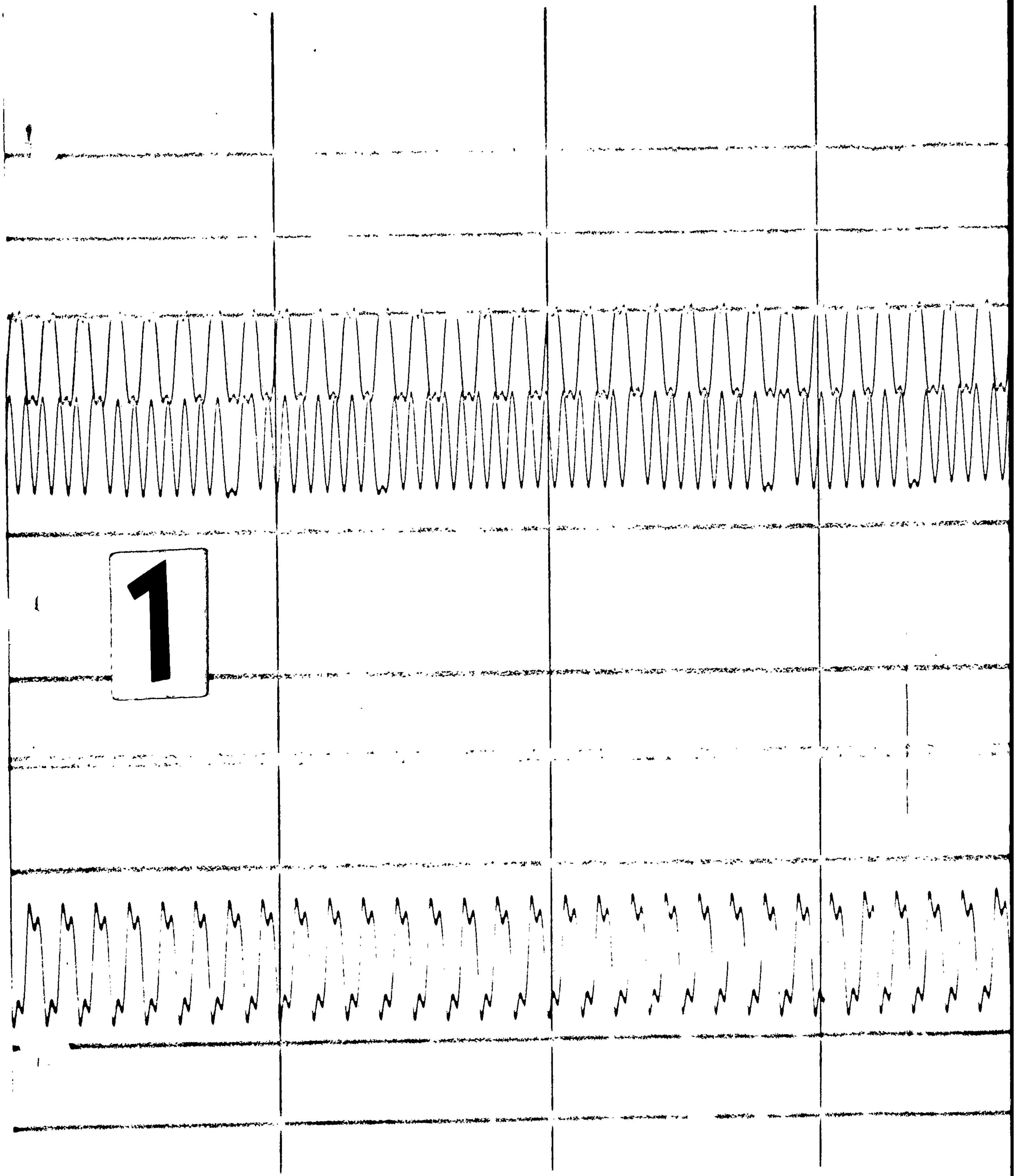
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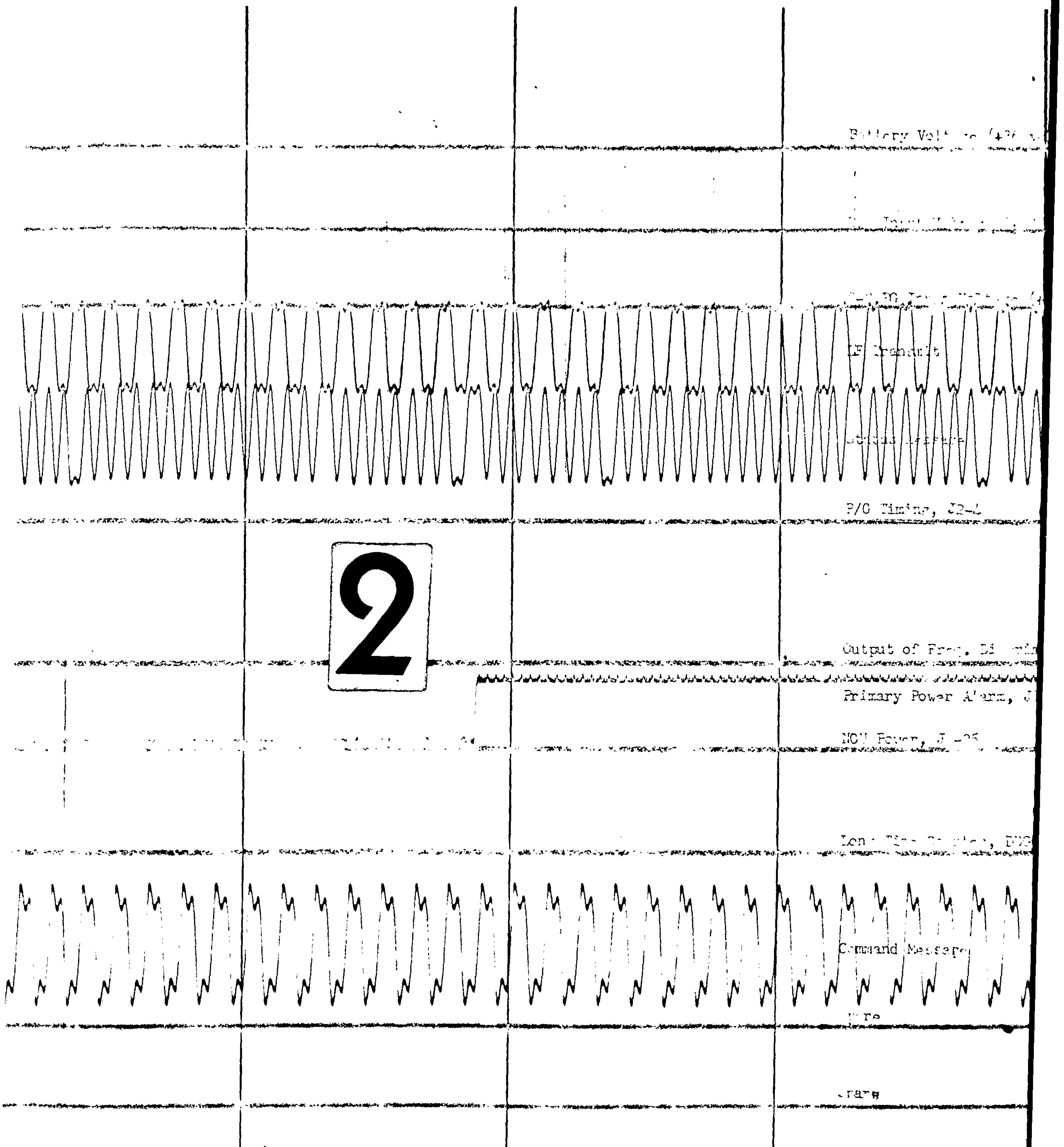
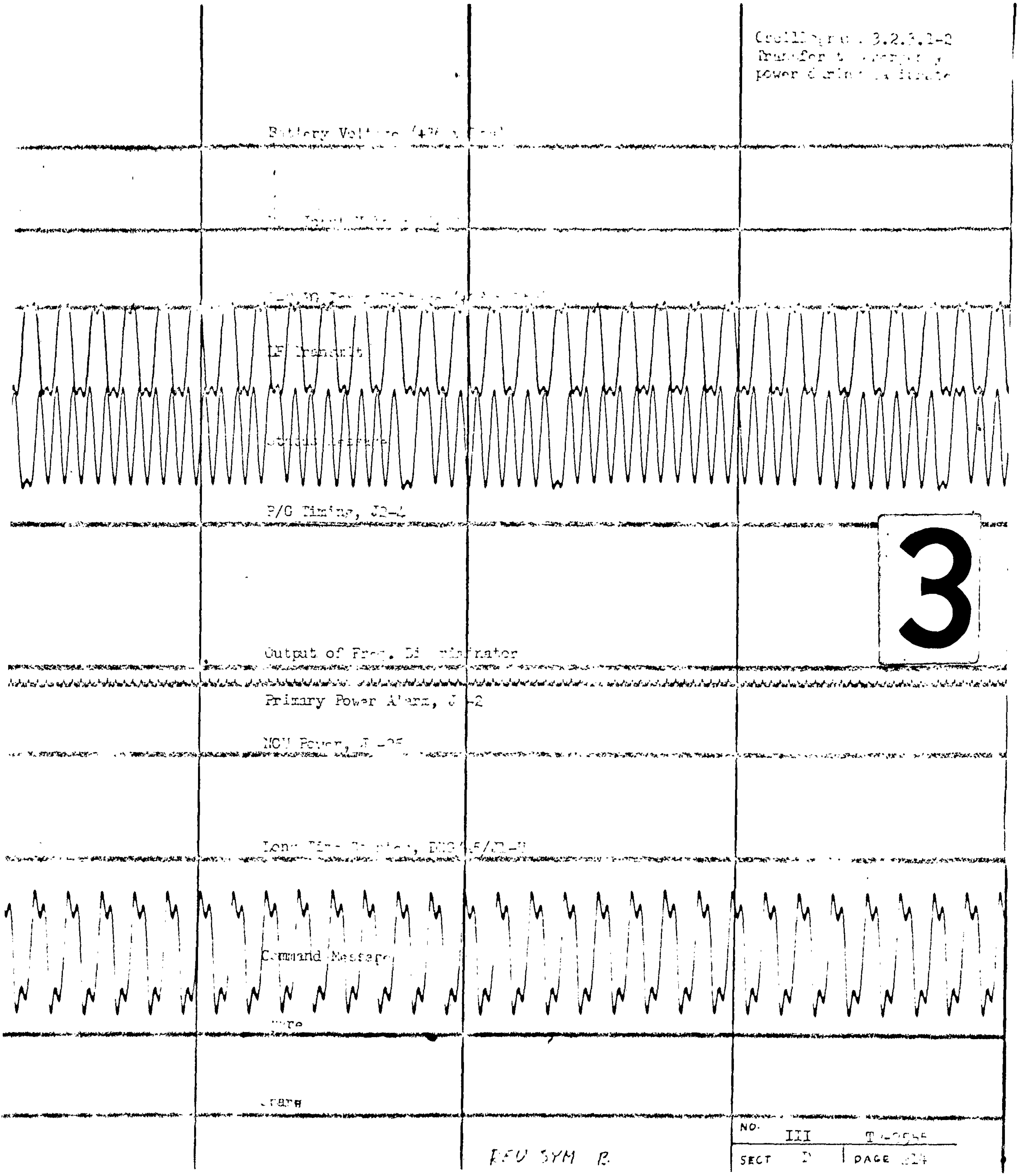
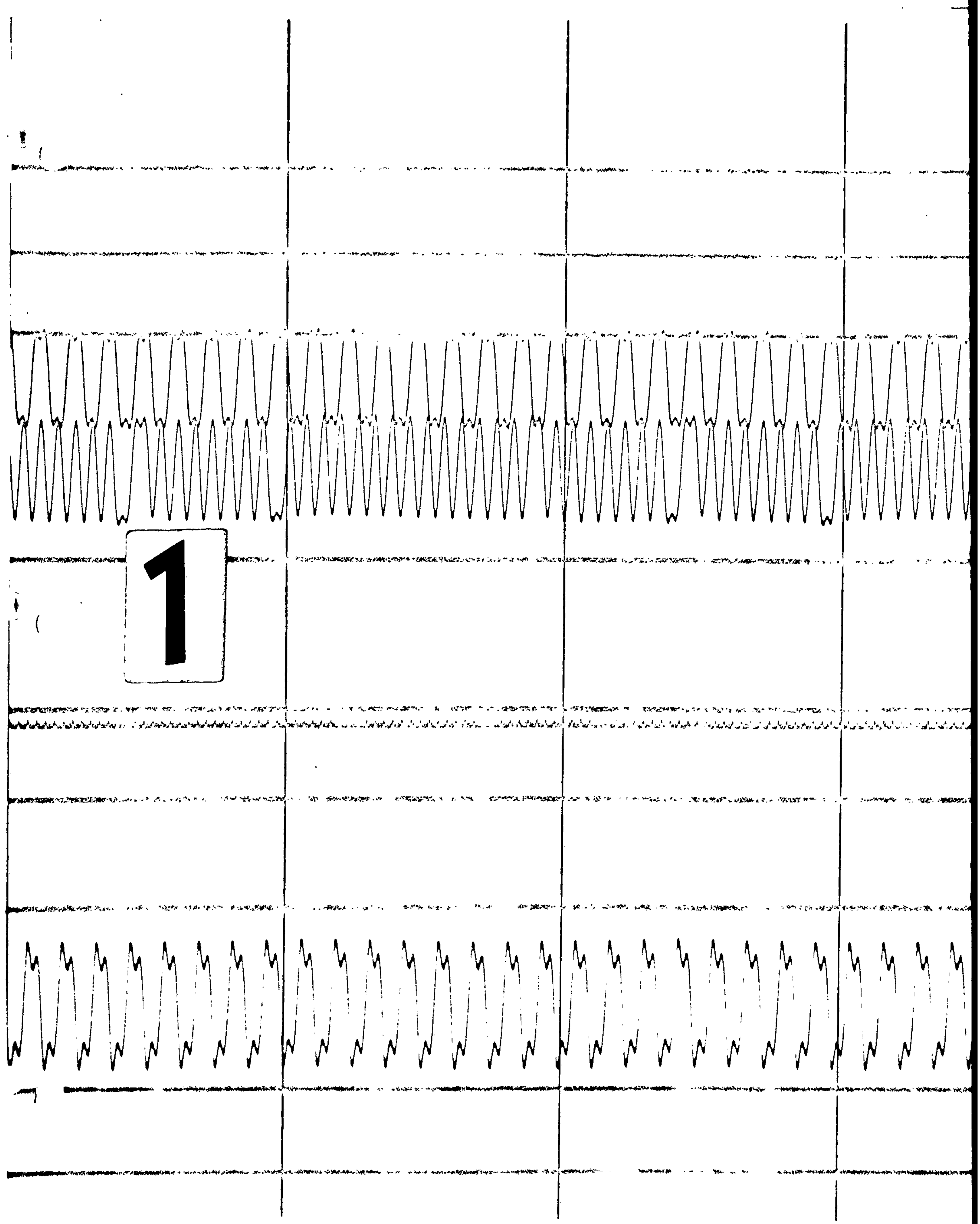

2
P/G Timing, J2-4
Output of Freq.
Primary Power
Command Message



NO. III
SECT
PAGE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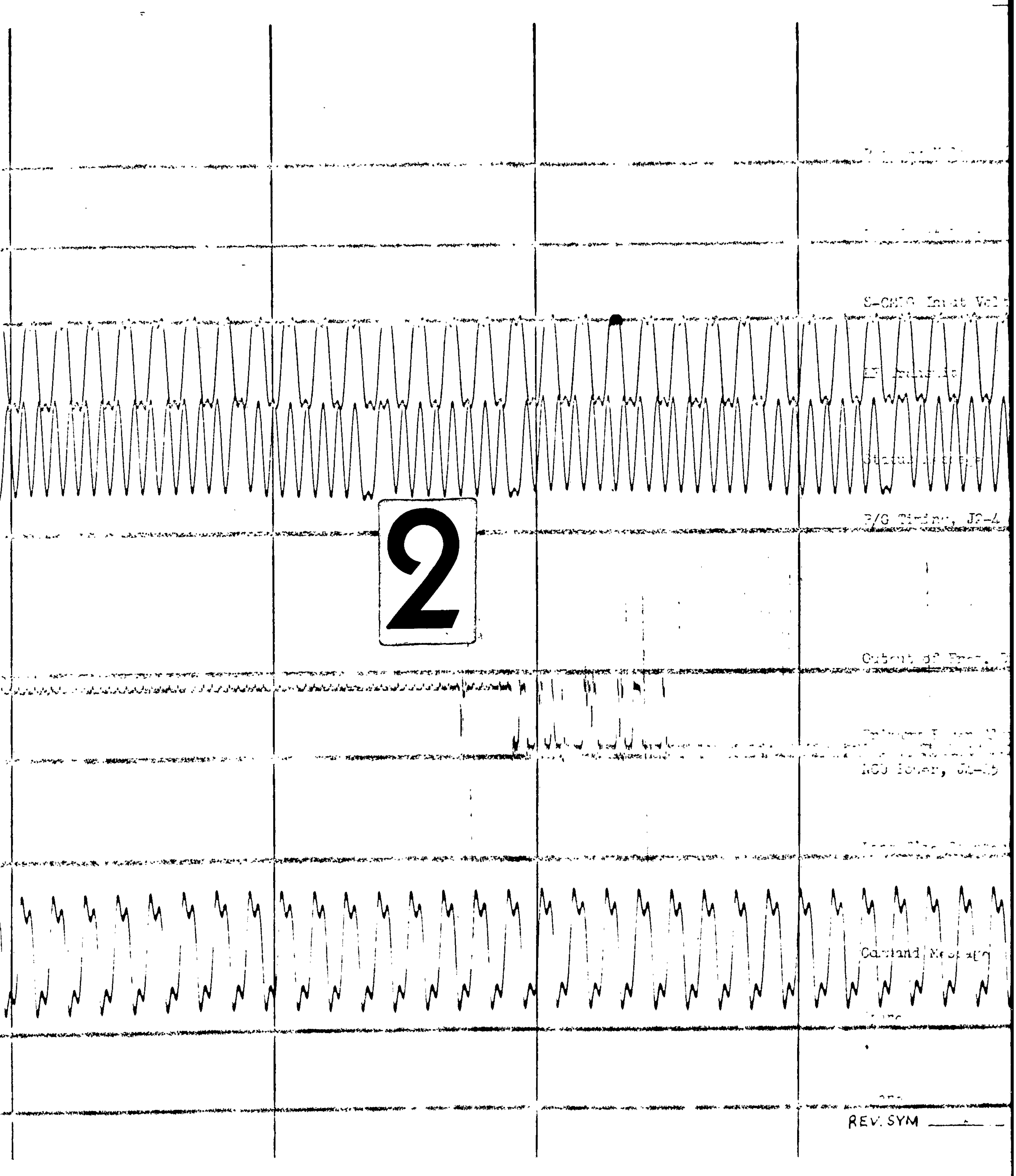
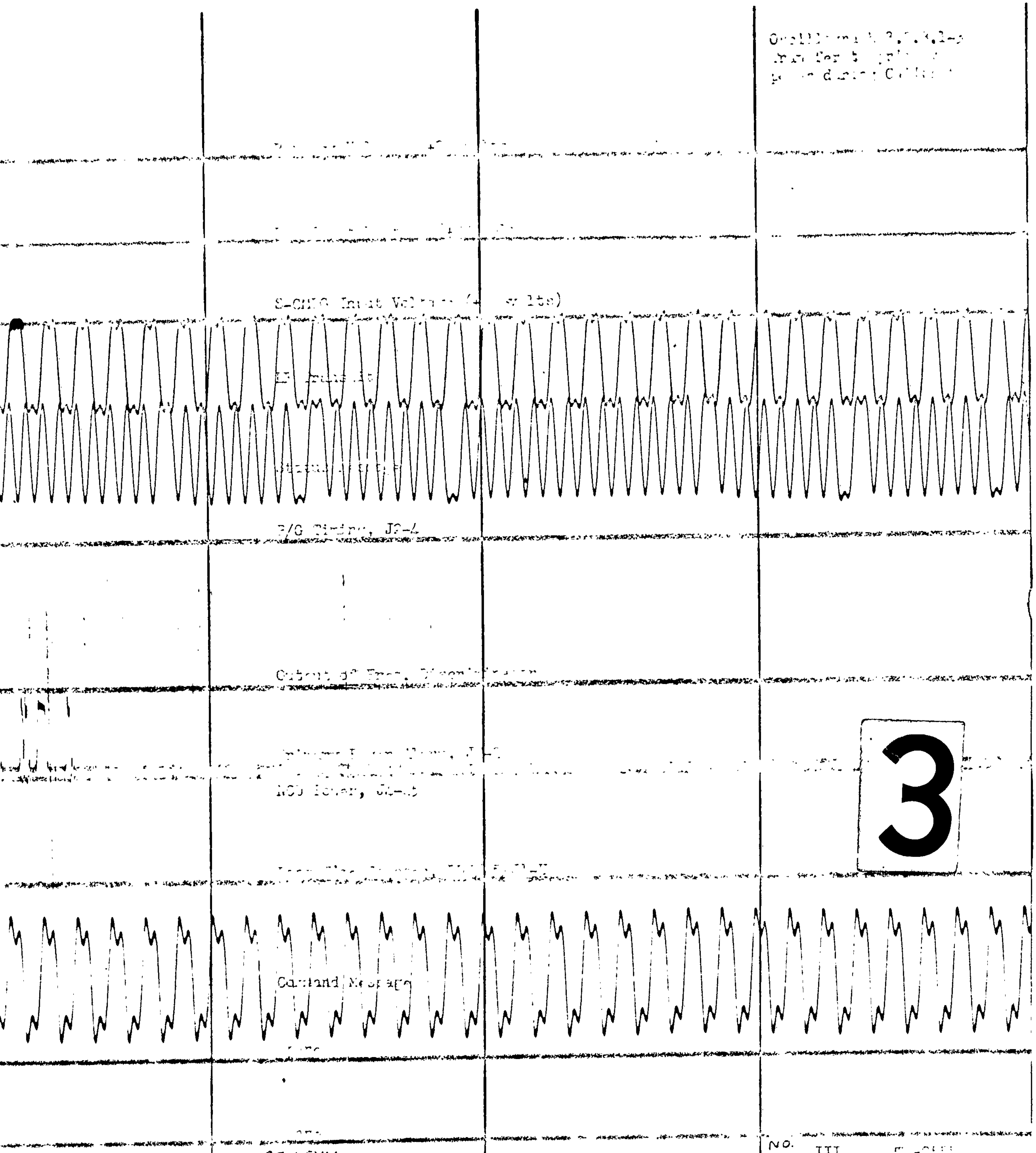
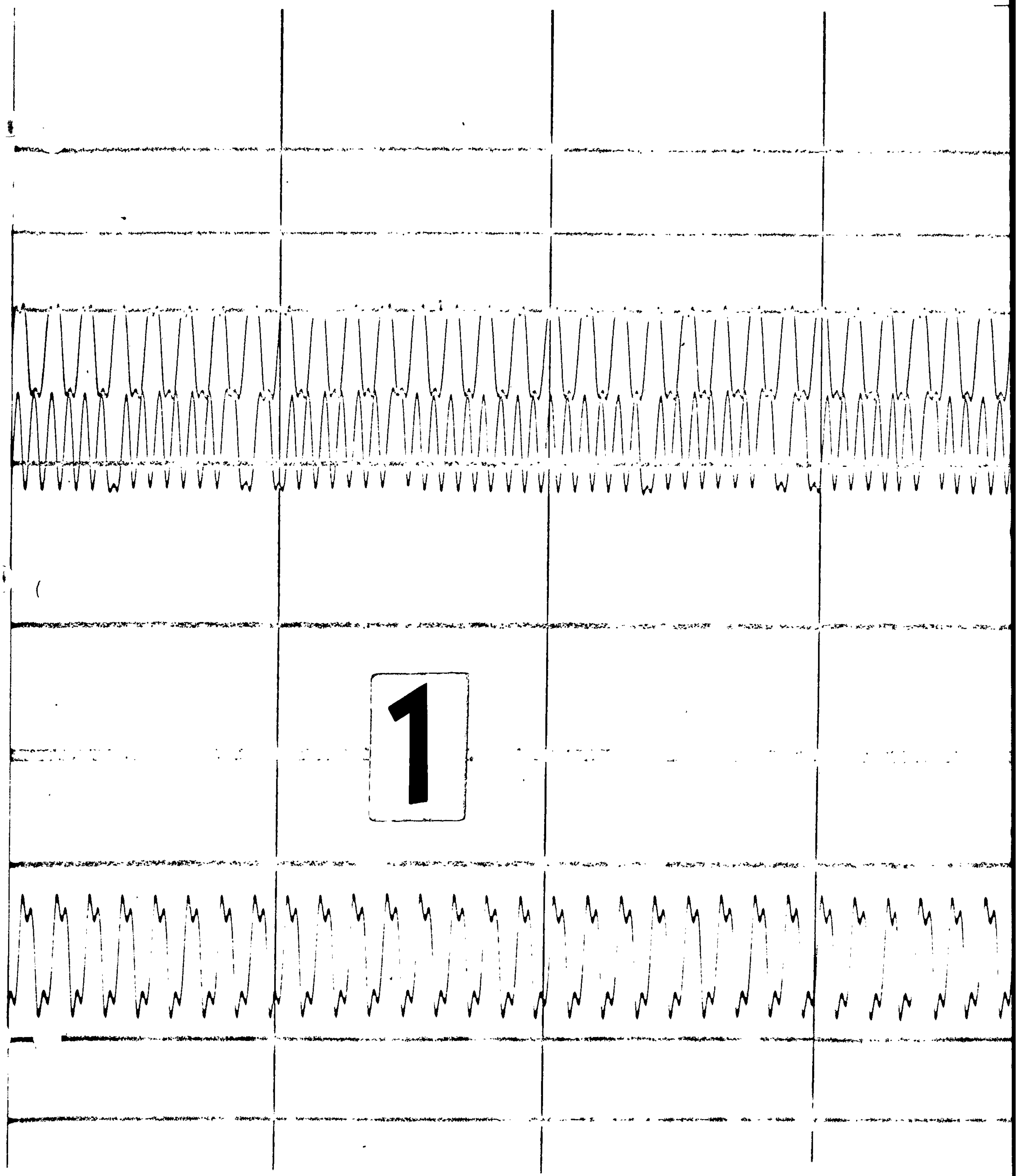

2
REV. SYM


Command Message
3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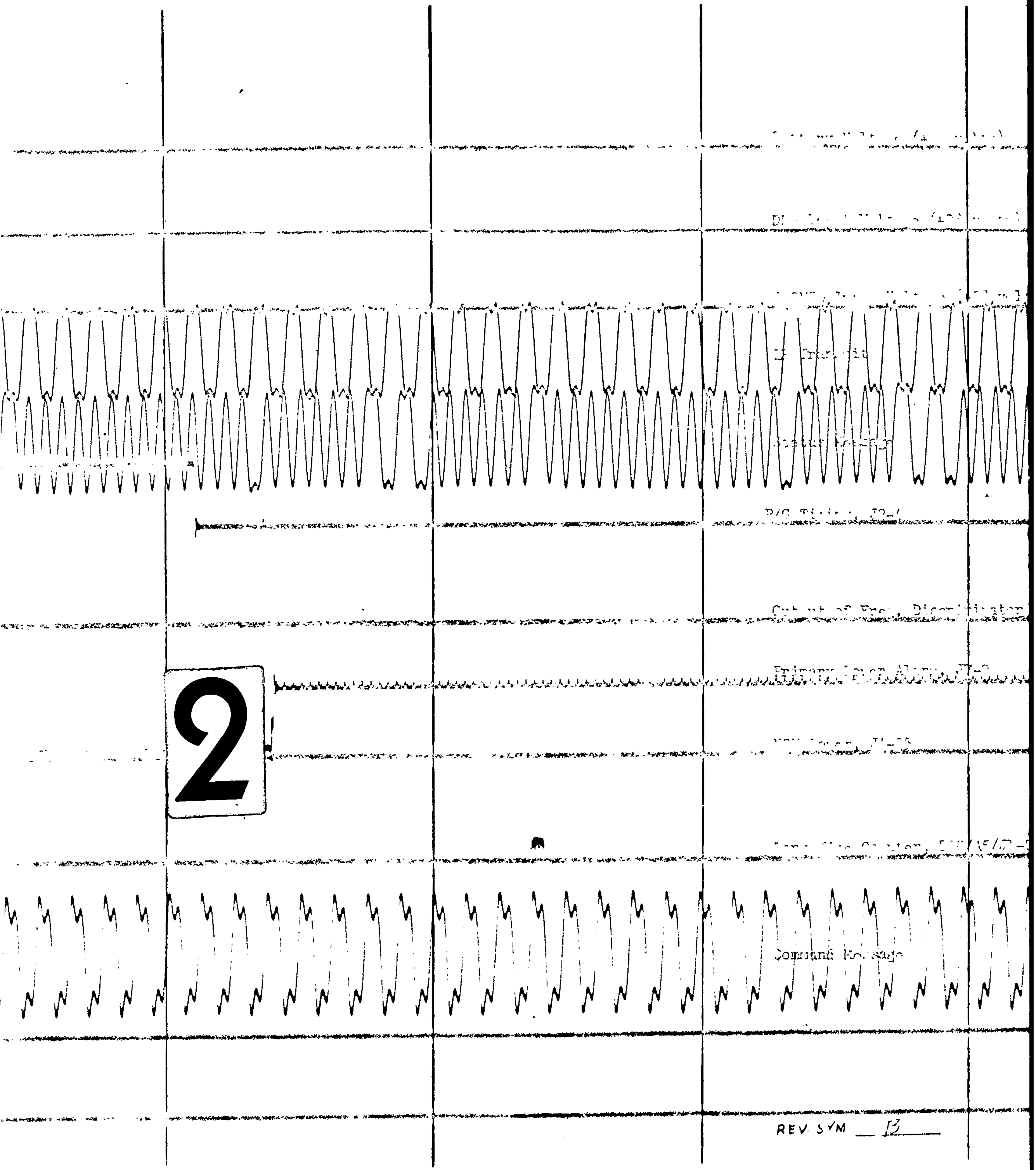
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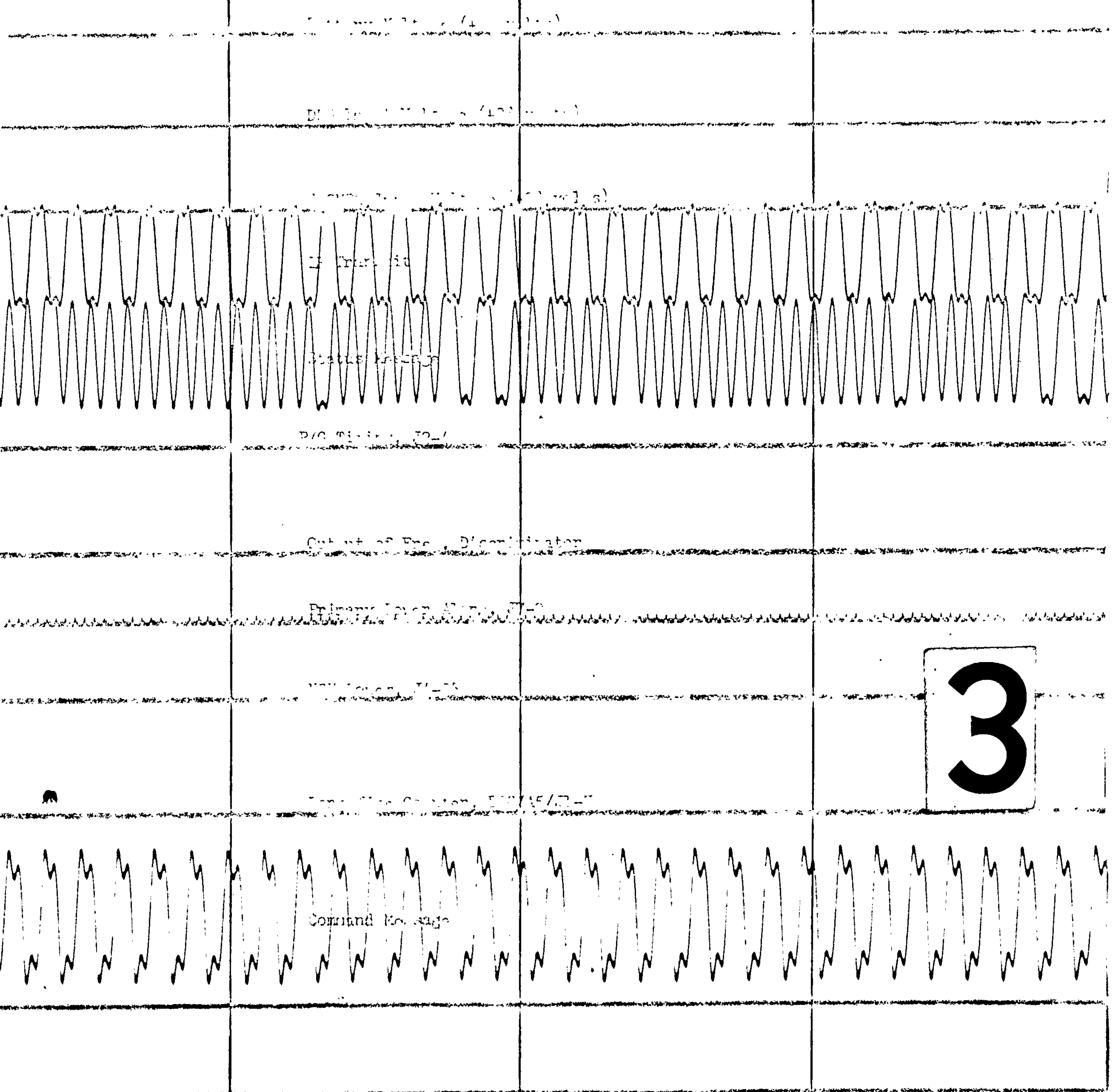
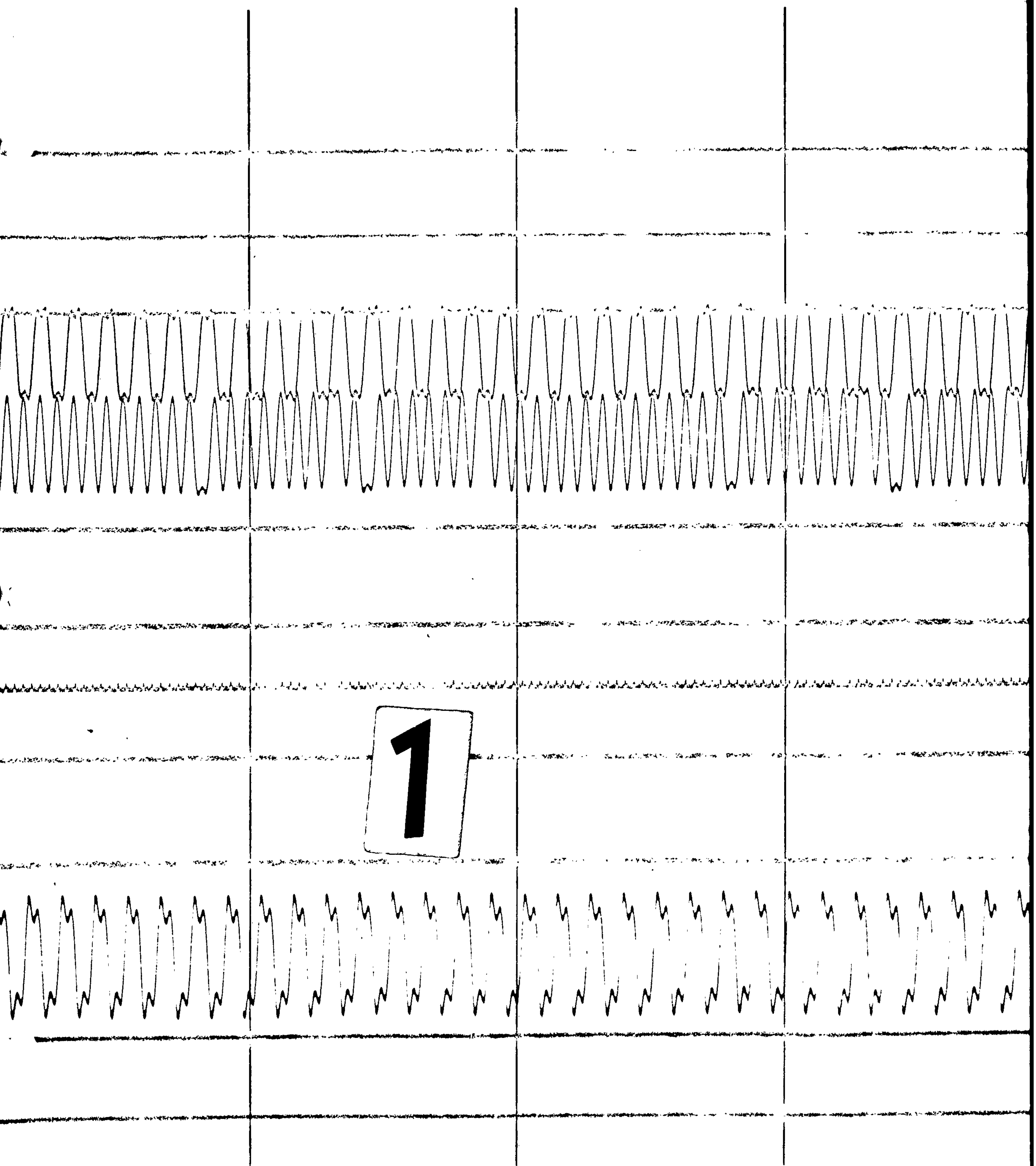
Command Message
REV. SYM B

Oscillograph 3.2.3.1-4
Transfer to emergency
power during [illegible]

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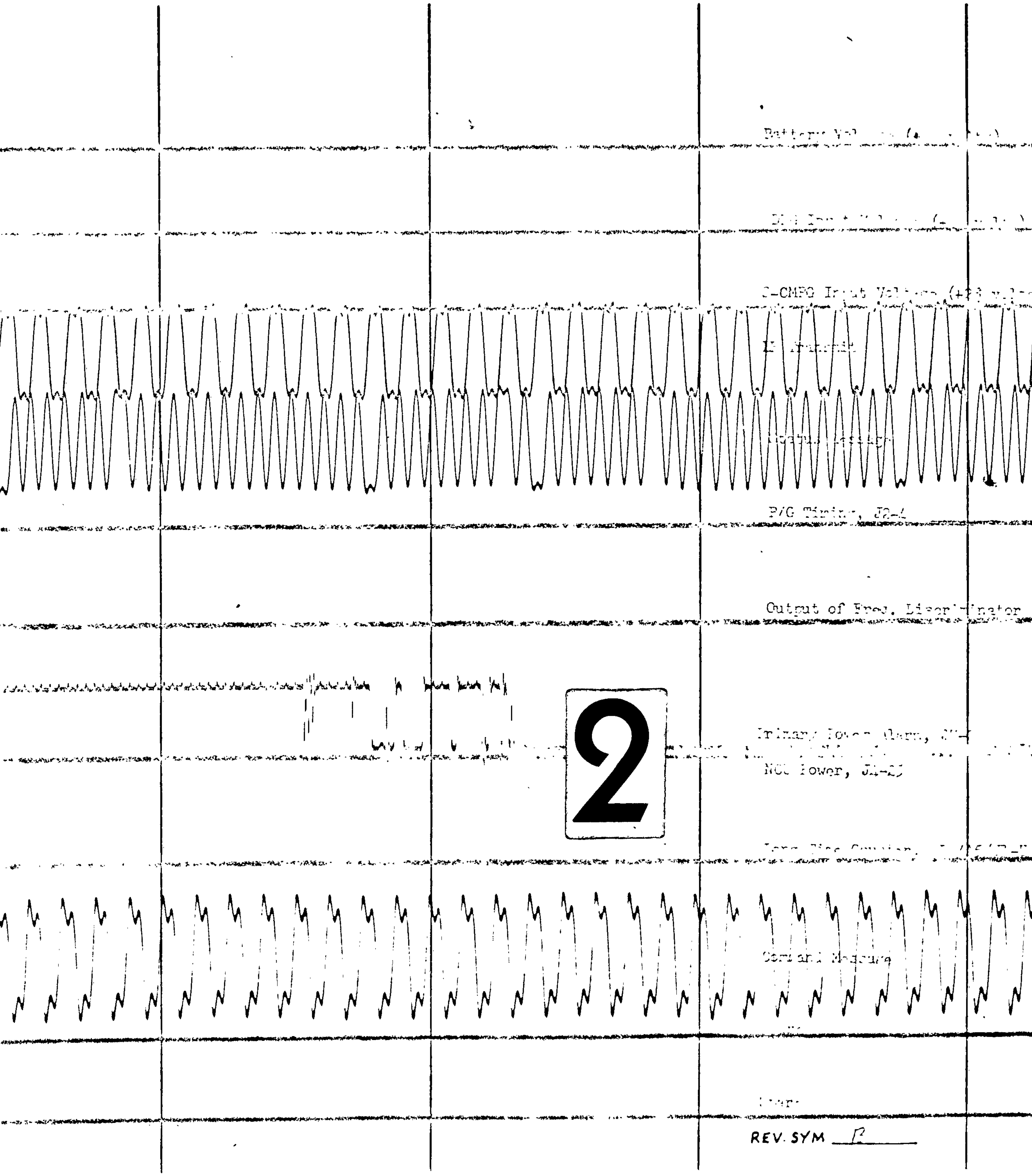
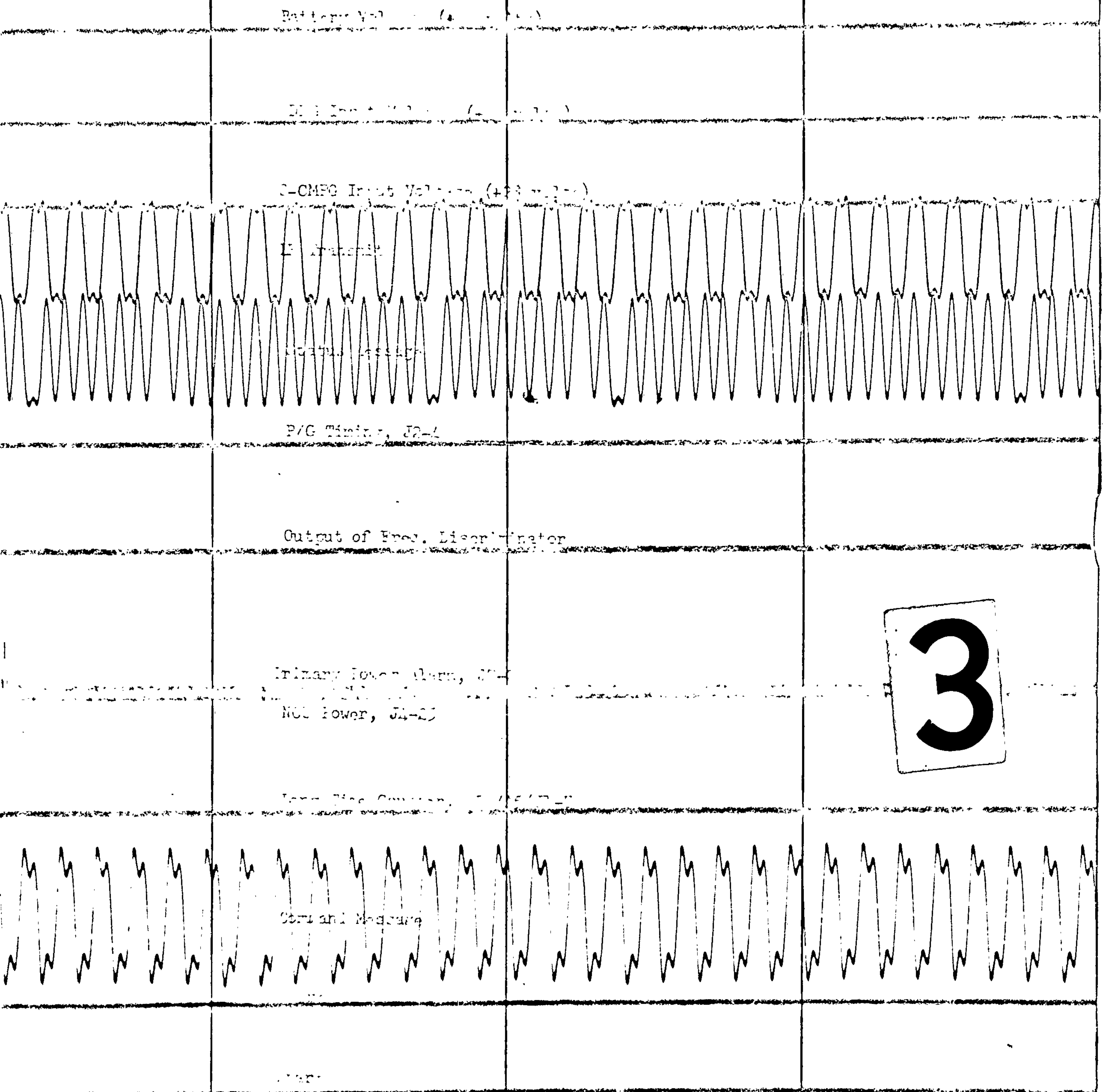
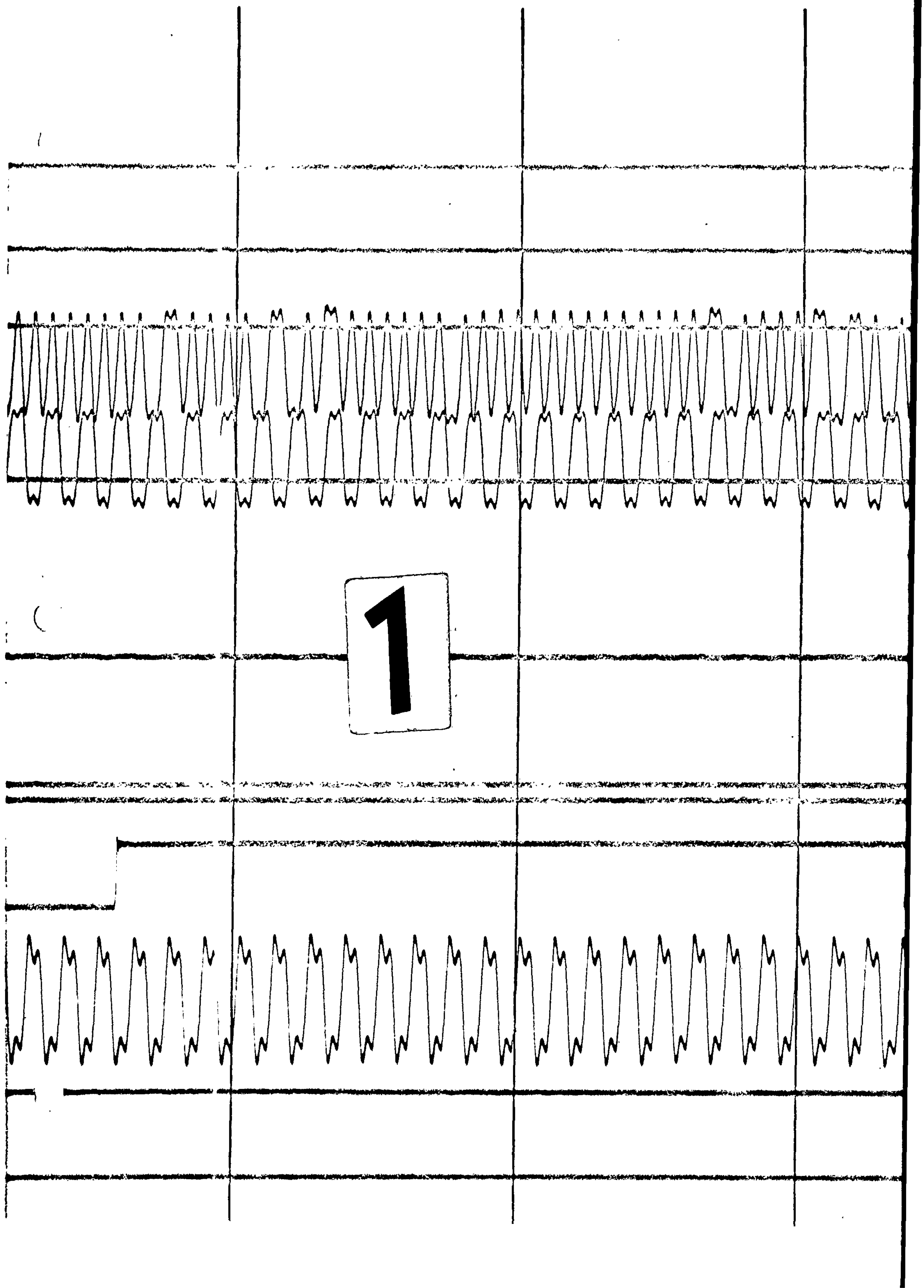

2
REV. SYM

Oscillog[illegible]h 3.2.3.1-5
[illegible] for to primary
power durin[illegible]

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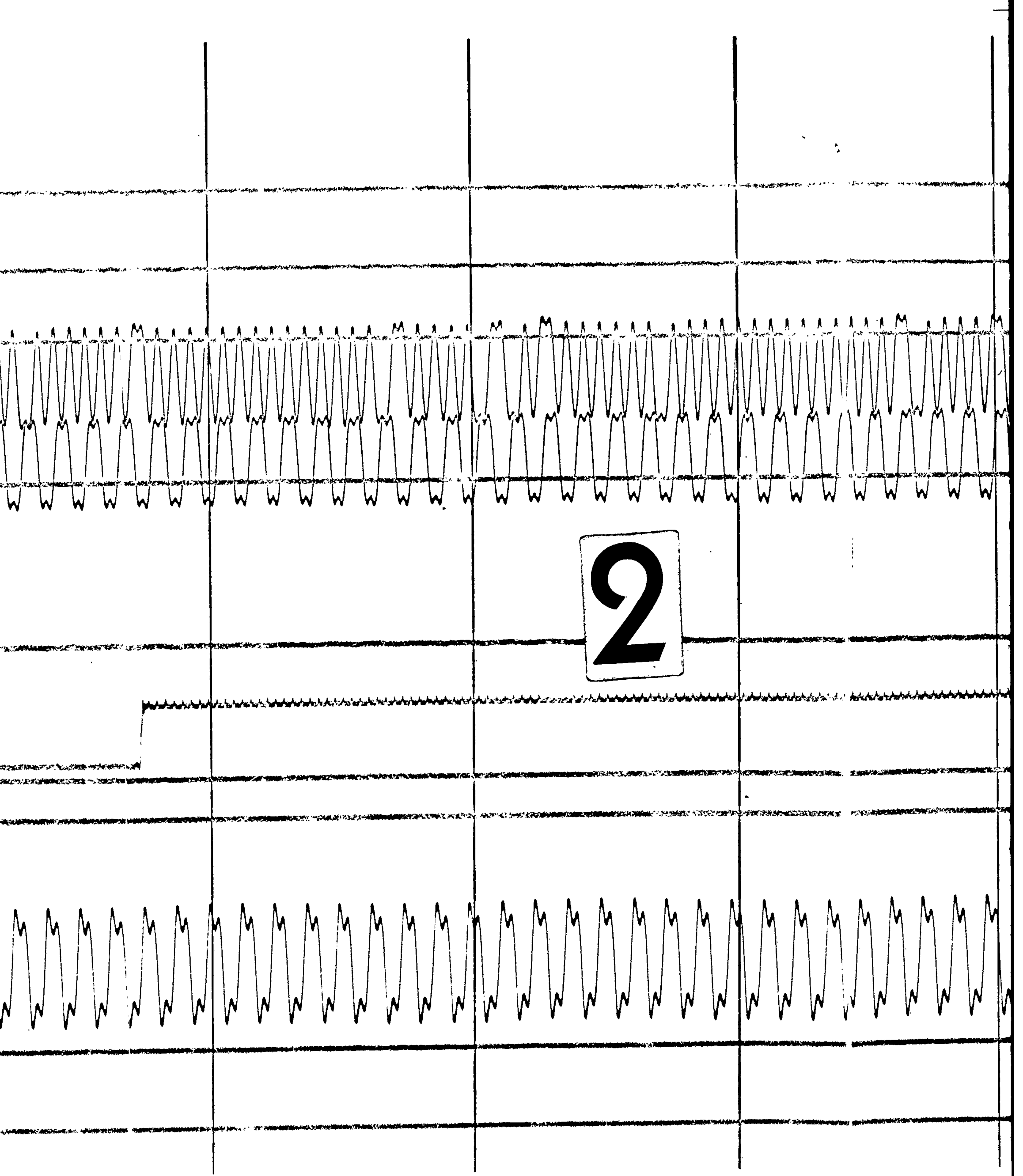
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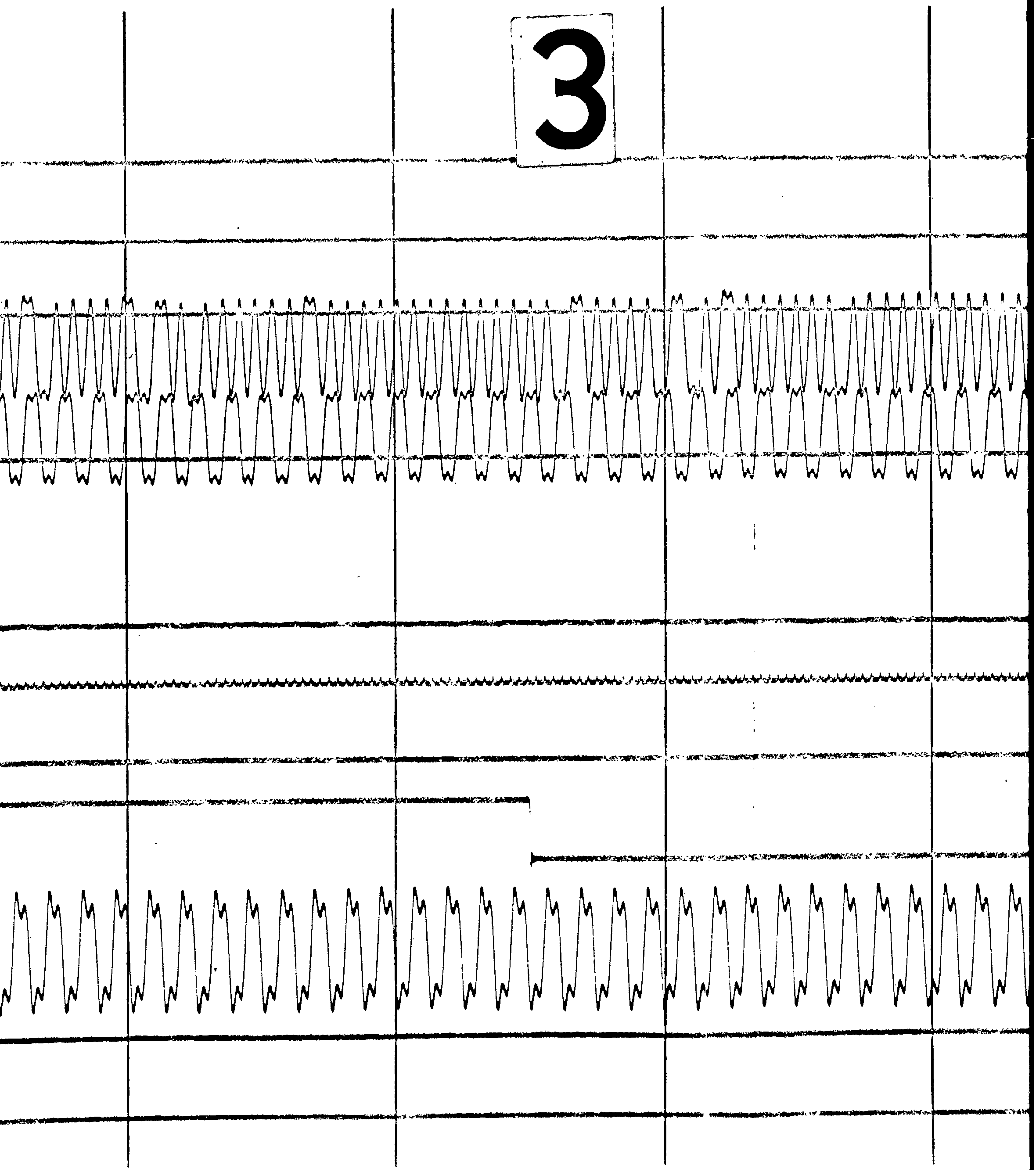
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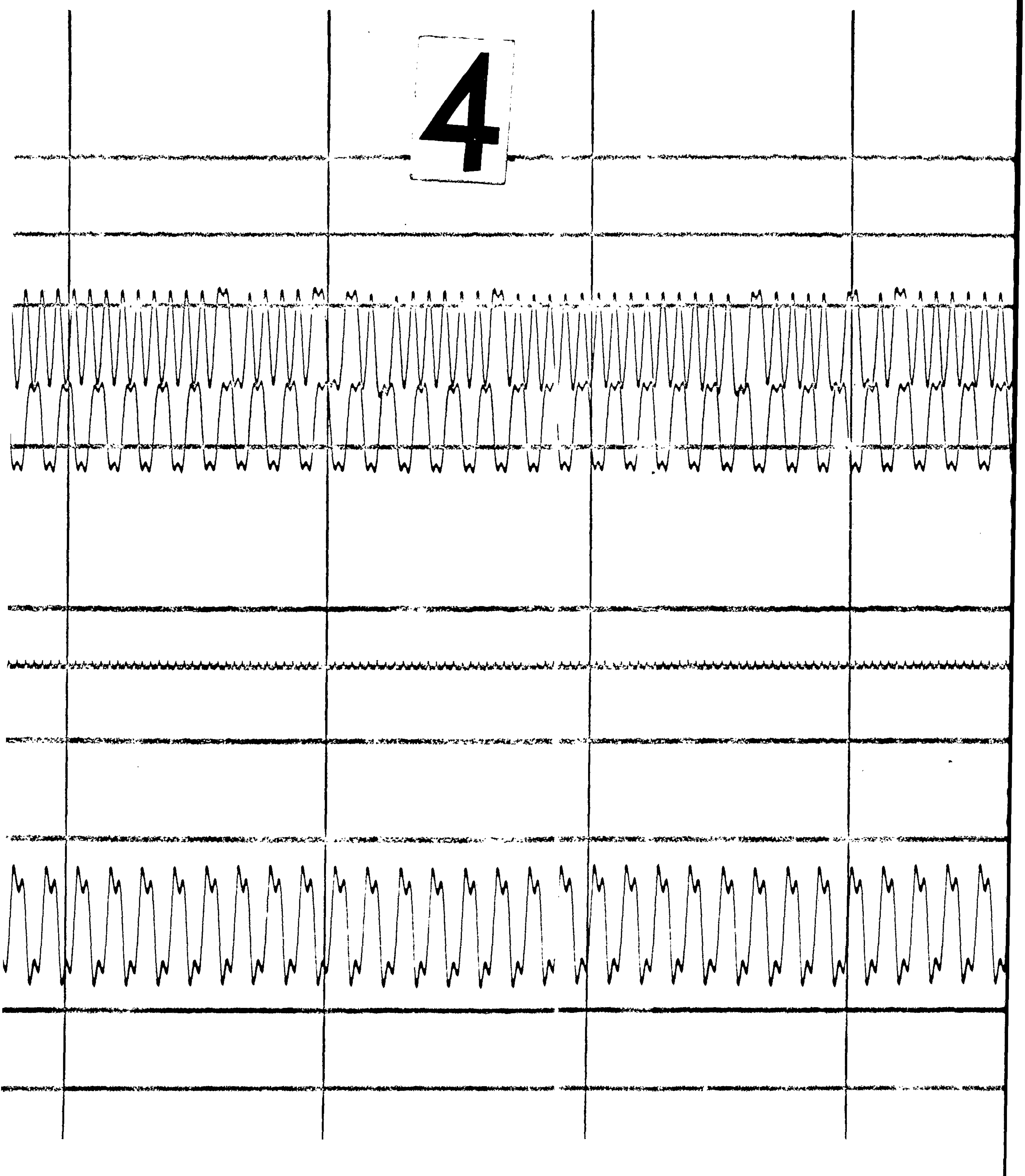
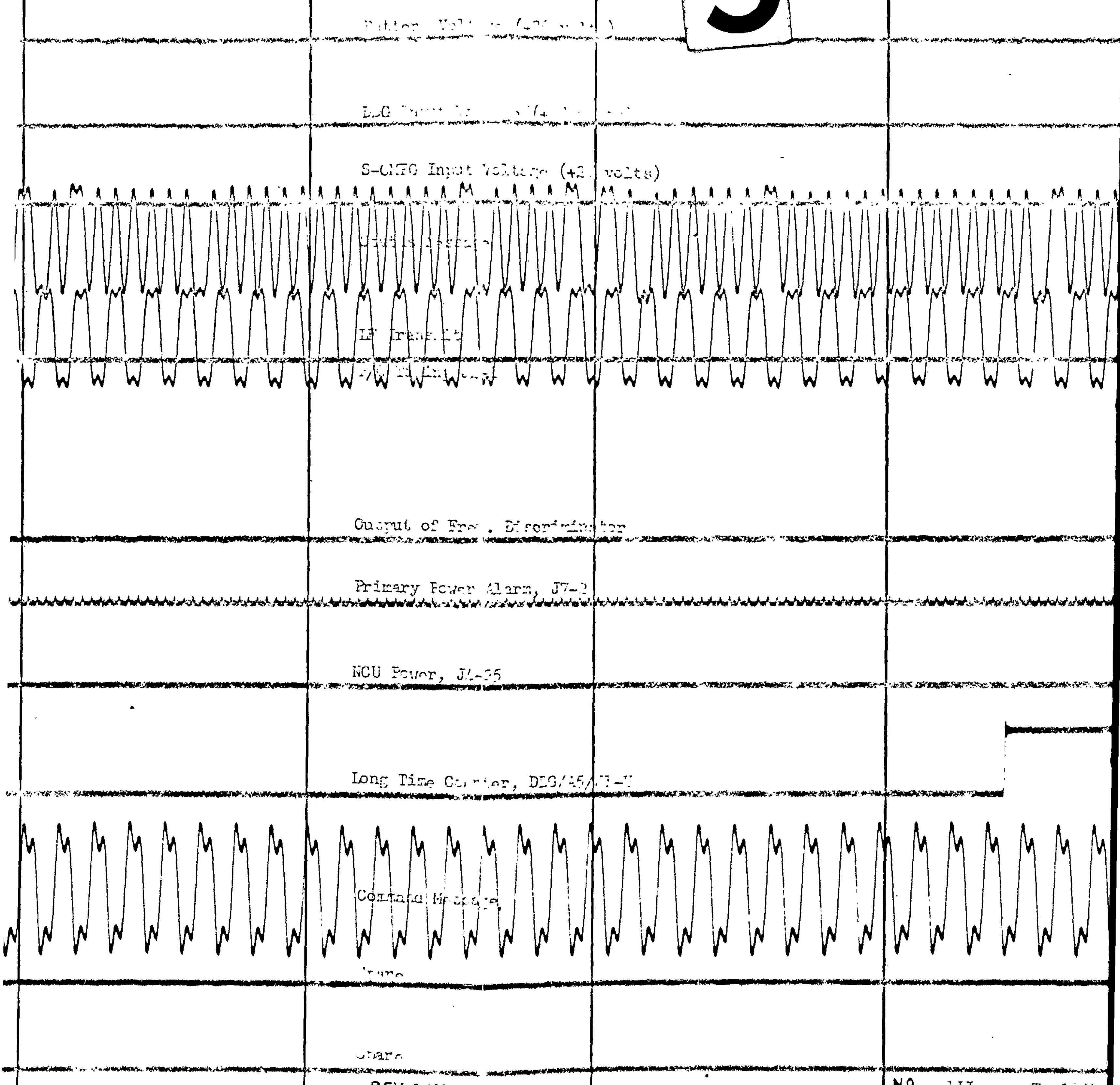
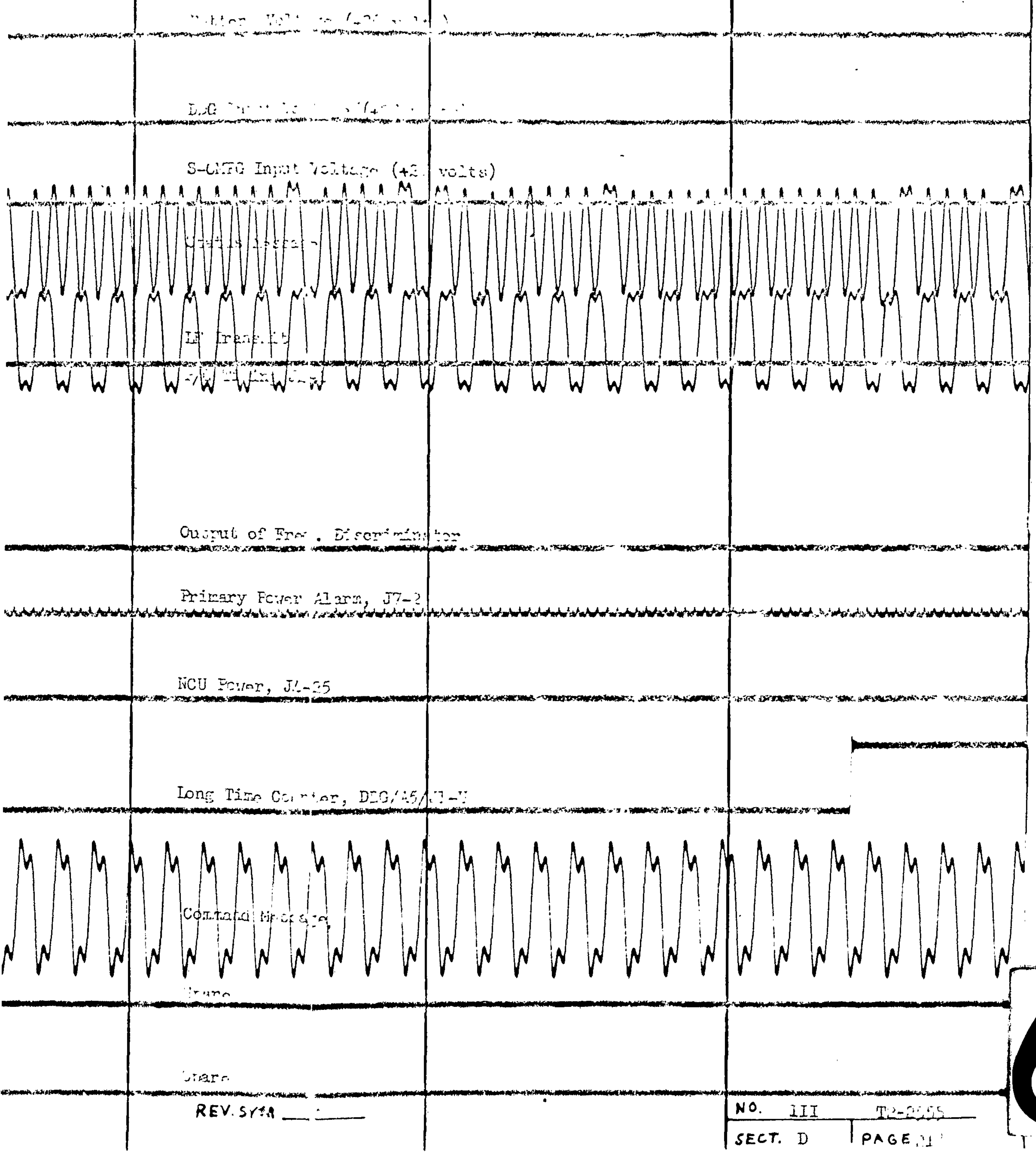
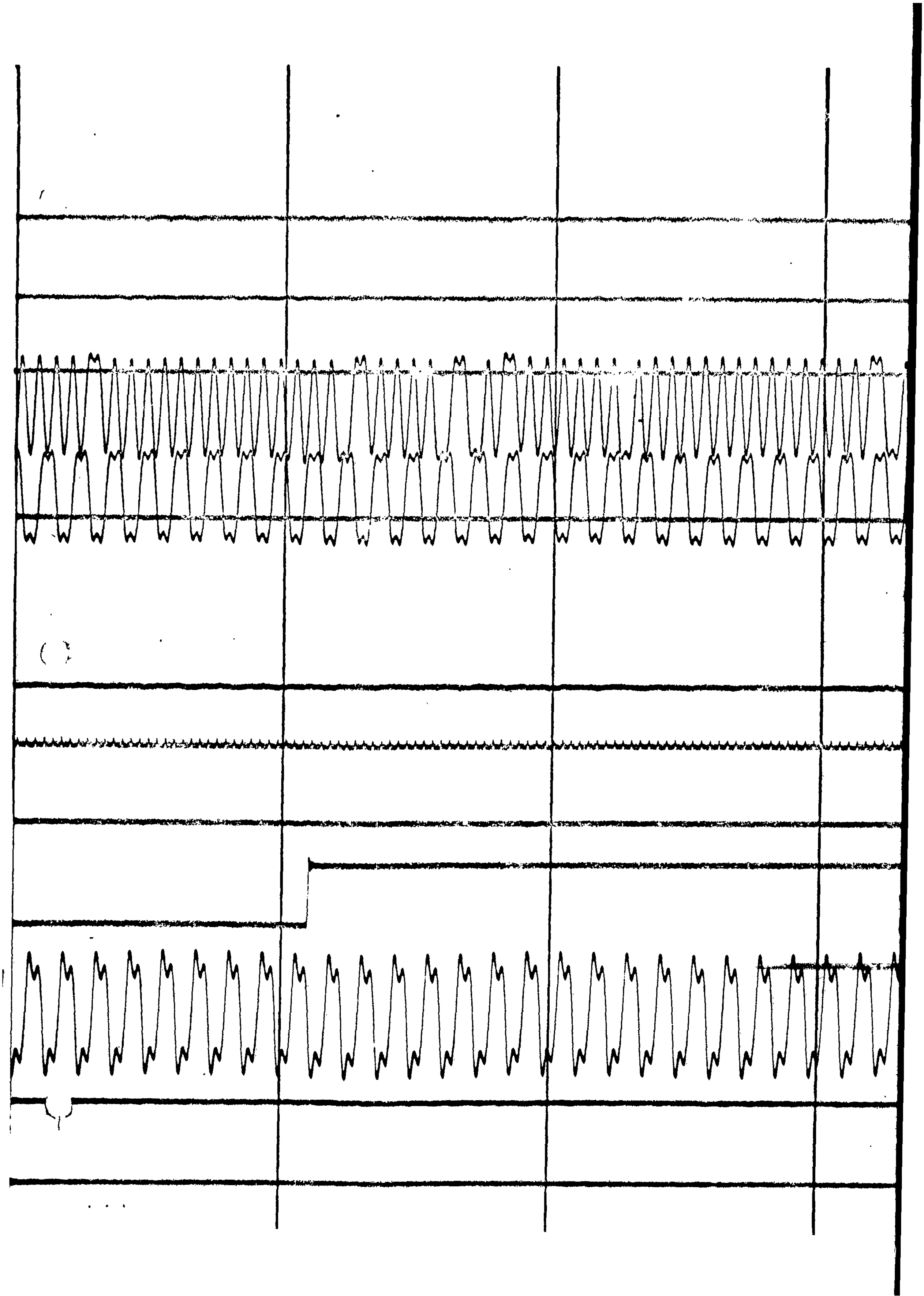

4

Oscillograph ?.2.?.1-6
Transfer to emergency power during Long Time Counter run-out

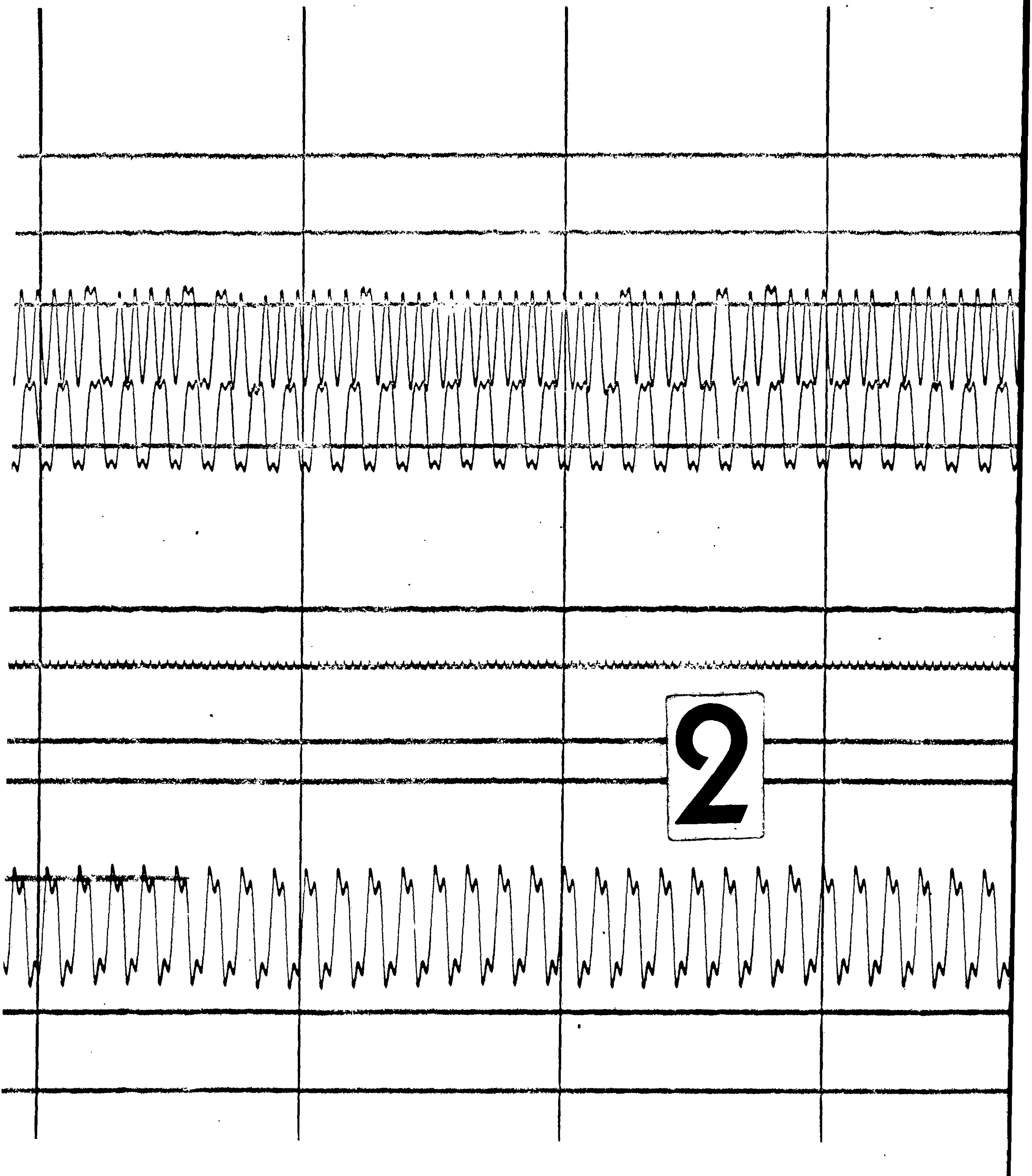


Oscillograph 5.2.5.1-6
Transfer to emergency
power during Long
Time Counter run-out





1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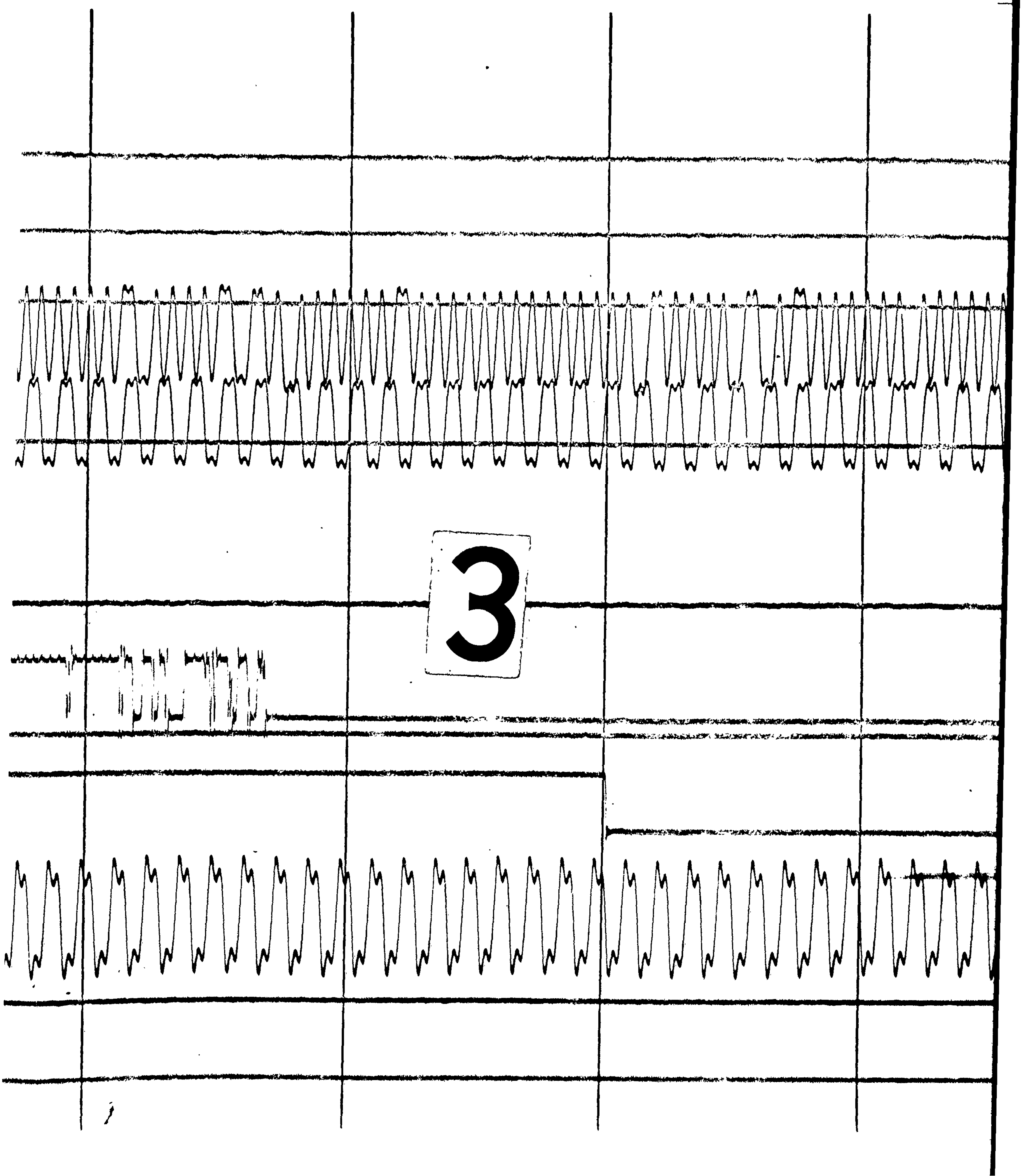
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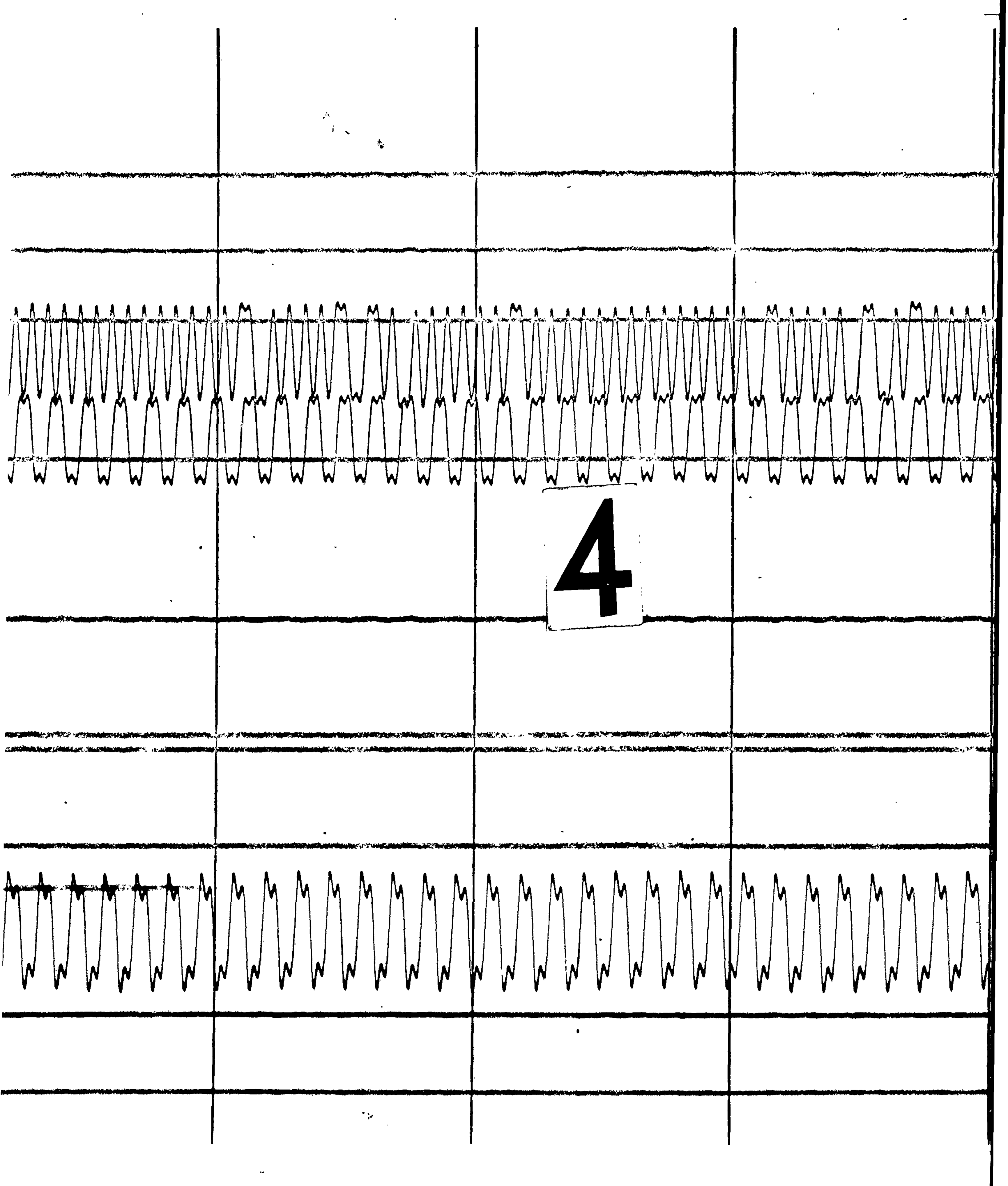
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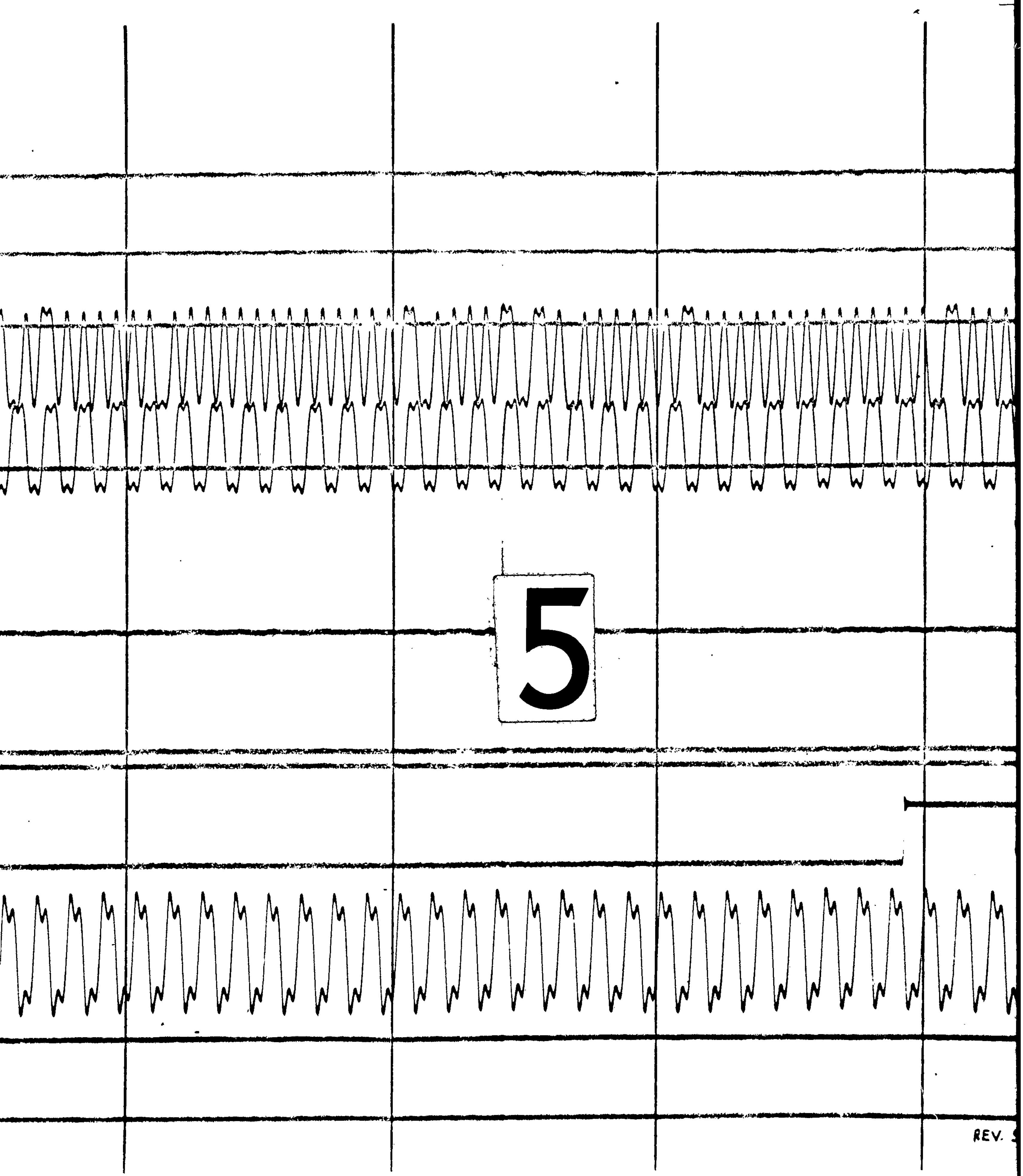
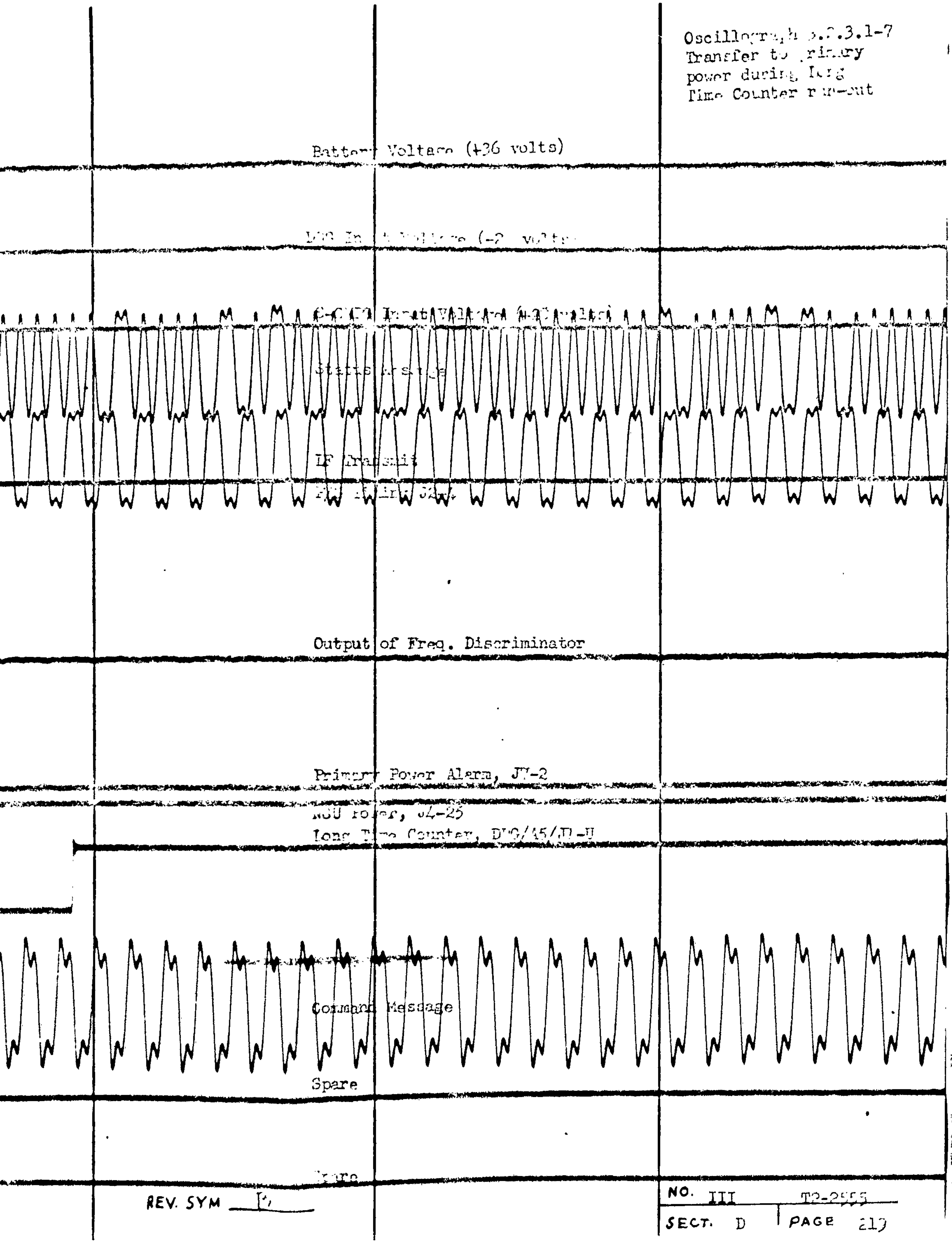

5
REV.

Oscillograph [illegible].3.1-7
Transfer to primary
power during long
Time Counter run-out



6

TEST REPORT 3.2.3.2

1. TITLE

D. C. Voltage Variation

2. OBJECTIVE

To investigate the effects of varying the D. C. voltage to the LF/SCN.

3. CONSLUSIONS

3.1 The LF/SCN correctly processed Test, SCN Test, and Launch Commands from the LCF/SCN at input voltages below the 27.5 volt specification. Voltage was lowered to 21.73 volts.

3.2 Correct status indications were obtained at the Launch Control Console for each Command.

3.3 As the voltage was decreased, the activation time of the Safety Control Switch increased. At 21.73 volts, 5 seconds were required for the "Armed" lamp to come on at the LCC, as compared to 1.5 seconds at 28 volts input voltage.

4. EQUIPMENT IN TEST

4.1 Digital Data Group, P/N 8323616-505, A/N 0000005

4.2 Status - Command Message Processing Group, P/N 8323617-503

5. TEST DESCRIPTION

5.1 The equipment was connected per Figure 3.0.0.0-1 with one exception. In order to obtain voltages lower than 27.5 volts, it was necessary to connect the two LF/SCN racks to an auxiliary power supply, rather than the LF Power Supply Group.

5.2 Instrumentation was connected as follows:

LF/DDG +28 Volt Input	401A7J2-A
LF/SCMPG +28 Volt Input	402A7J2-B
Long Time Counter	401A6J1-u
LF Status Message - Diphase	F2ST
LF Transmit - Diphase	F2X1

5.3 Voltage was raised to 29.86 VDC. The test procedure called for tests at the upper voltage limit (30.5 VDC). The power supplies used, however, would not operate at this voltage due to built in overvoltage sensing circuits. Rather than modify the power supplies it was decided to use the upper limit of the power supplies as the maximum voltage condition.

5.4 The Programmer and Coupler were placed in Strategic Alert per Test 3.2.2.2 of D2-13406, Vol. III.

5.5 A test was sent from the LCC and status recorded per table 3.2.3.1-1. Status was observed at the Status Display Panel at the LCC.

5.6 Paragraph 4.5 was reported for SCN test and a one-vote Launch.

5.7 Voltage to the SCN was lowered in one volt steps from the lower specification limit of 27.5 volts. At each setting paragraphs 4.4, 4.5, and 4.6 were repeated. In order to obtain the low voltage, it was necessary to disable the undervoltage sensing of the auxiliary power supplies. This was accomplished without modifying the supplies by simply holding in the Reset button.

5.8 At 23 volts, two Launch votes were sent to the LF.

6. <u>TEST SUMMARY</u>

6.1 Two LSU faults were observed in the first part of the test. LSU faults have appeared randomly during previous tests. It is believed that they are caused by a random reset pulse which resets part of the SCN Logic. Pin 27 of A10 in DDG drawer A6 was grounded to signal common to prevent reset pulses due to the faulty reset switch on the A6 drawer. This temporary fix proved to be effective, as no more LSU faults occurred during the test. It should be noted that the LSU faults occurred at the normal input voltage and were not peculiar to the low voltage conditions.

6.2 The lowest voltage obtainable with the auxiliary power supplies was 21.7 volts.

6.3 The LF/SCN correctly processed a two vote Launch at 23 volts. The Relay Drivers in the LF/SCN stepped out the Mechanical Decoder in the Programmer Group, and the launch proceeded normally, with correct status indications at the LCC.

7. <u>GENERAL INFORMATION</u>

7.1 Test Engineer: Norman Noe

7.2 Date test completed: 3/11/63

7.3 Applicable ER's:

+28 VOLTS 401 RACK 12-A

+28 VOLTS 402 RACK 12-A

LONG TIME COUNTER 461/A6/J1-U

STATUS

Sync

S/A

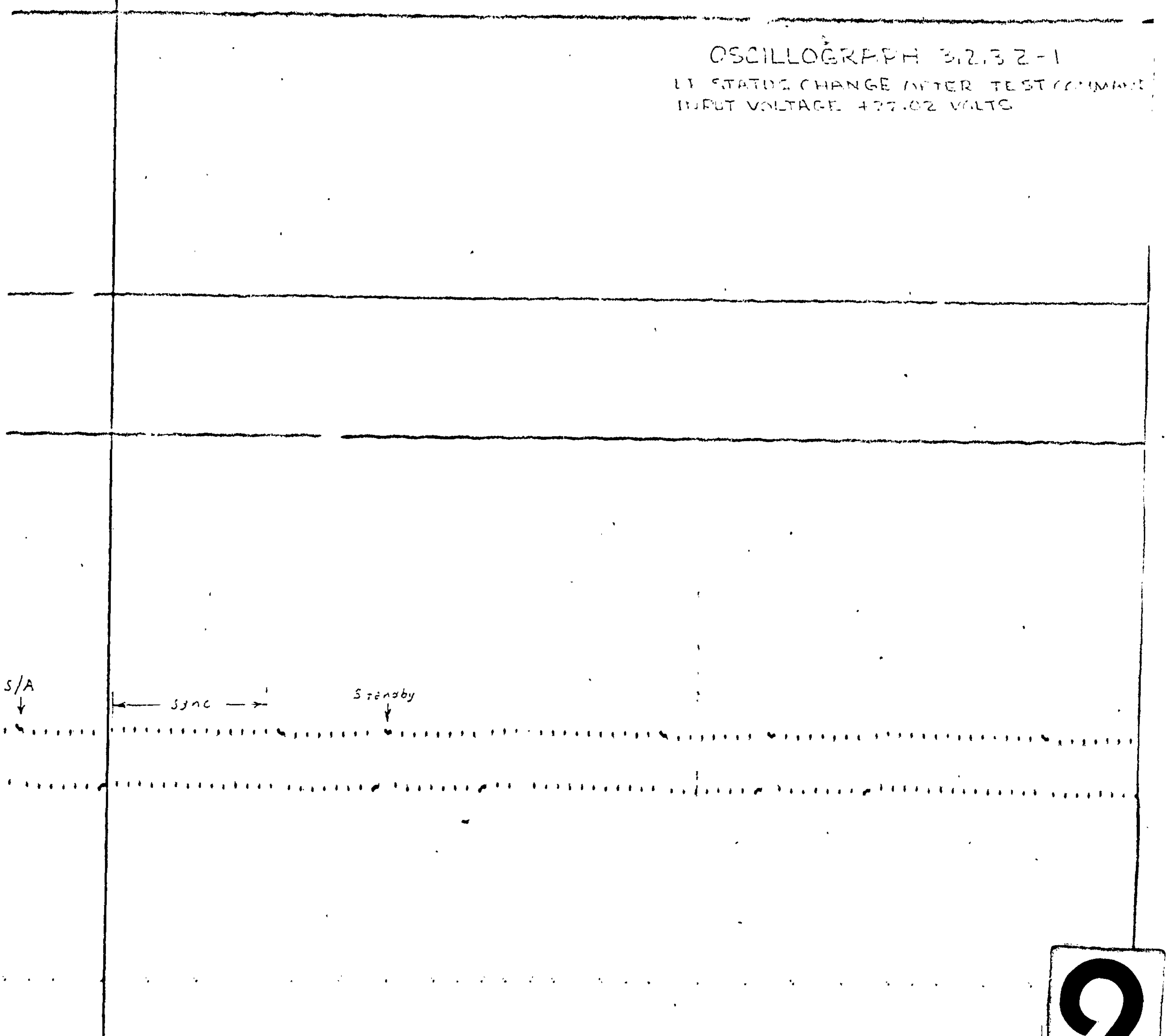
Sync

LF TRANSMISSION

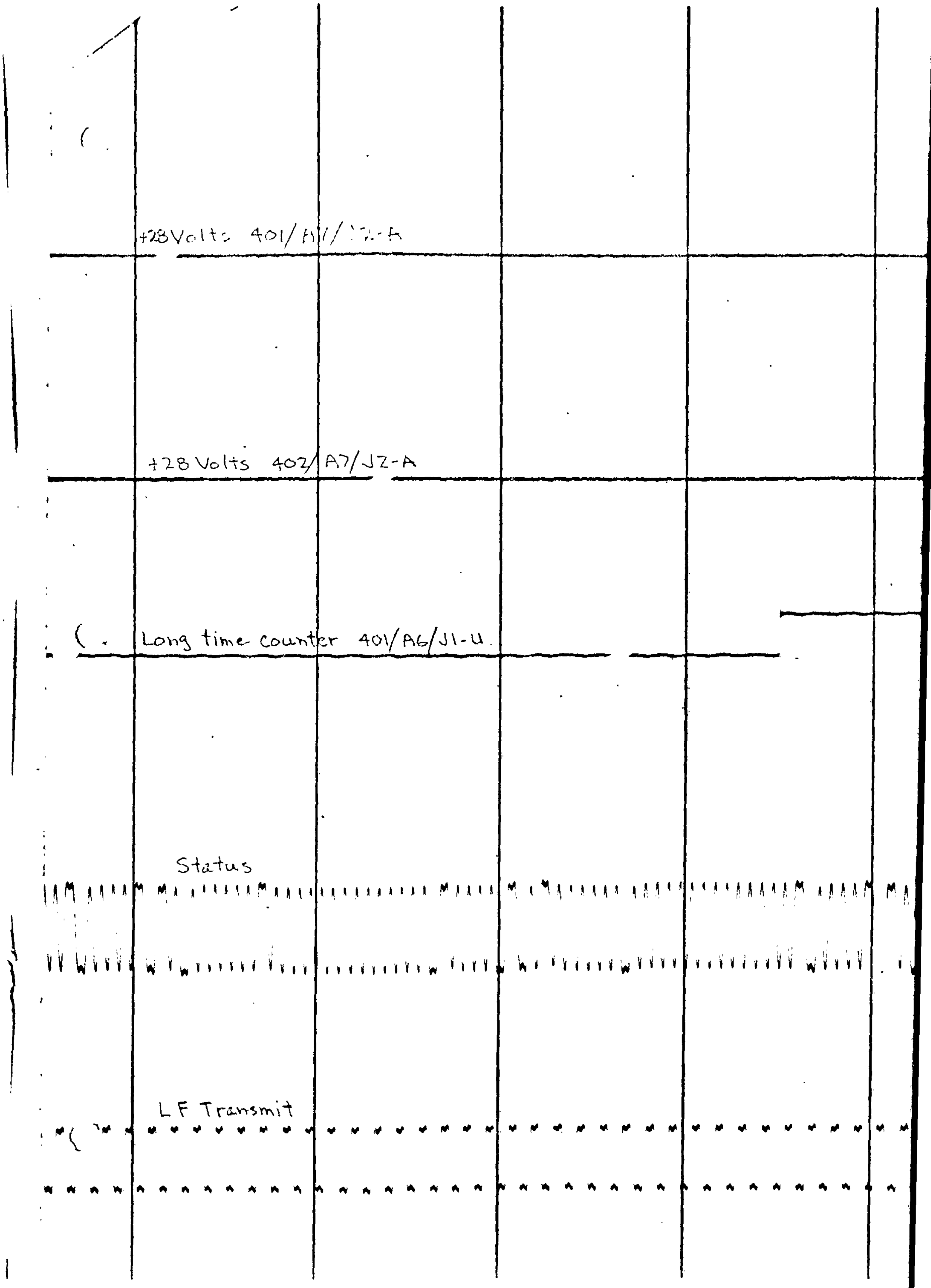
1

OSCILLOGRAPH 3.2.3.2-1

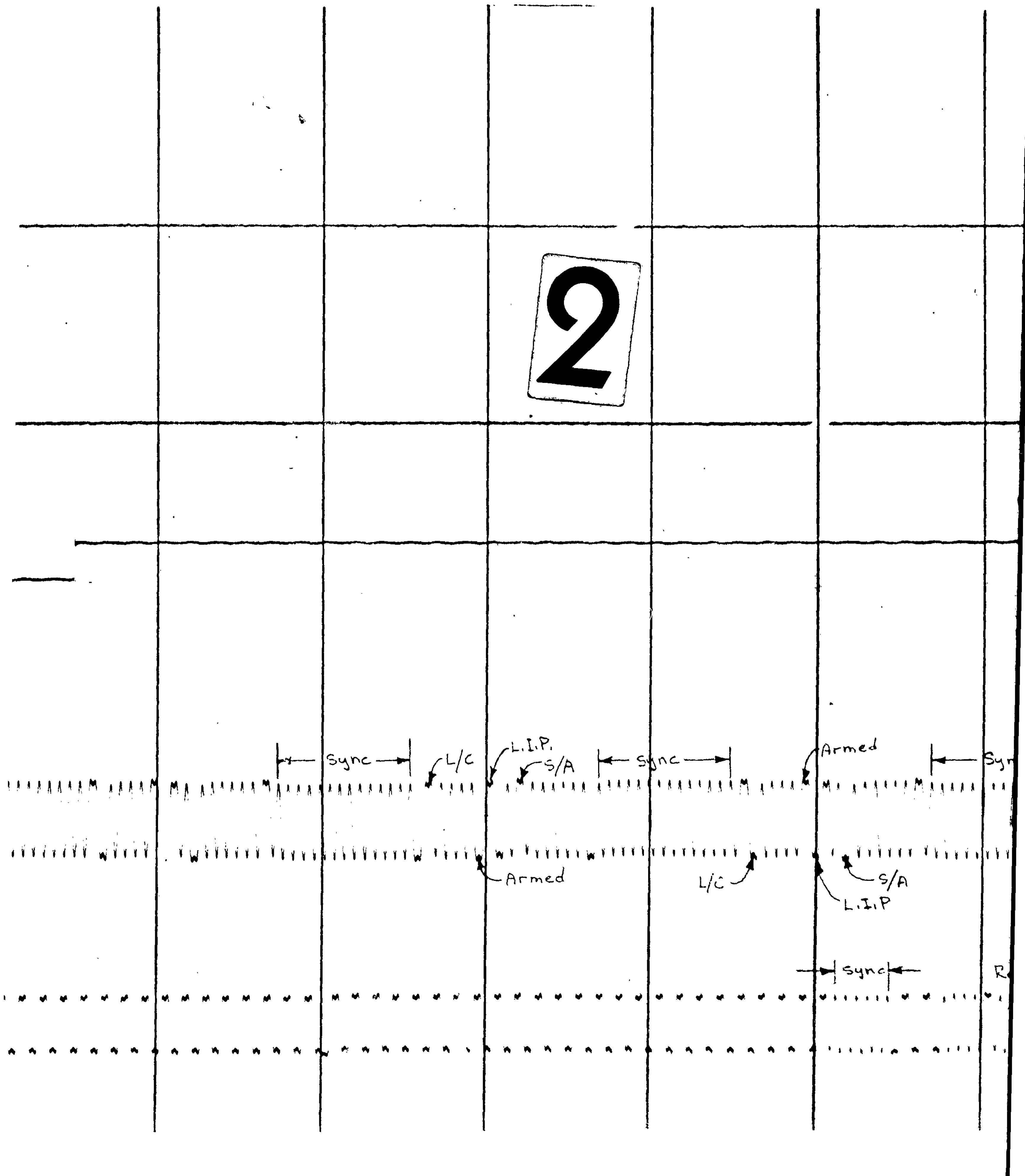
LT STATUS CHANGE AFTER TEST COMMAND
INPUT VOLTAGE +27.02 VOLTS



2


+28Volts 401/A
+28 Volts 402/A7/J2-A
Long time counter 401/A6/J1-U
Status
LF Transmit

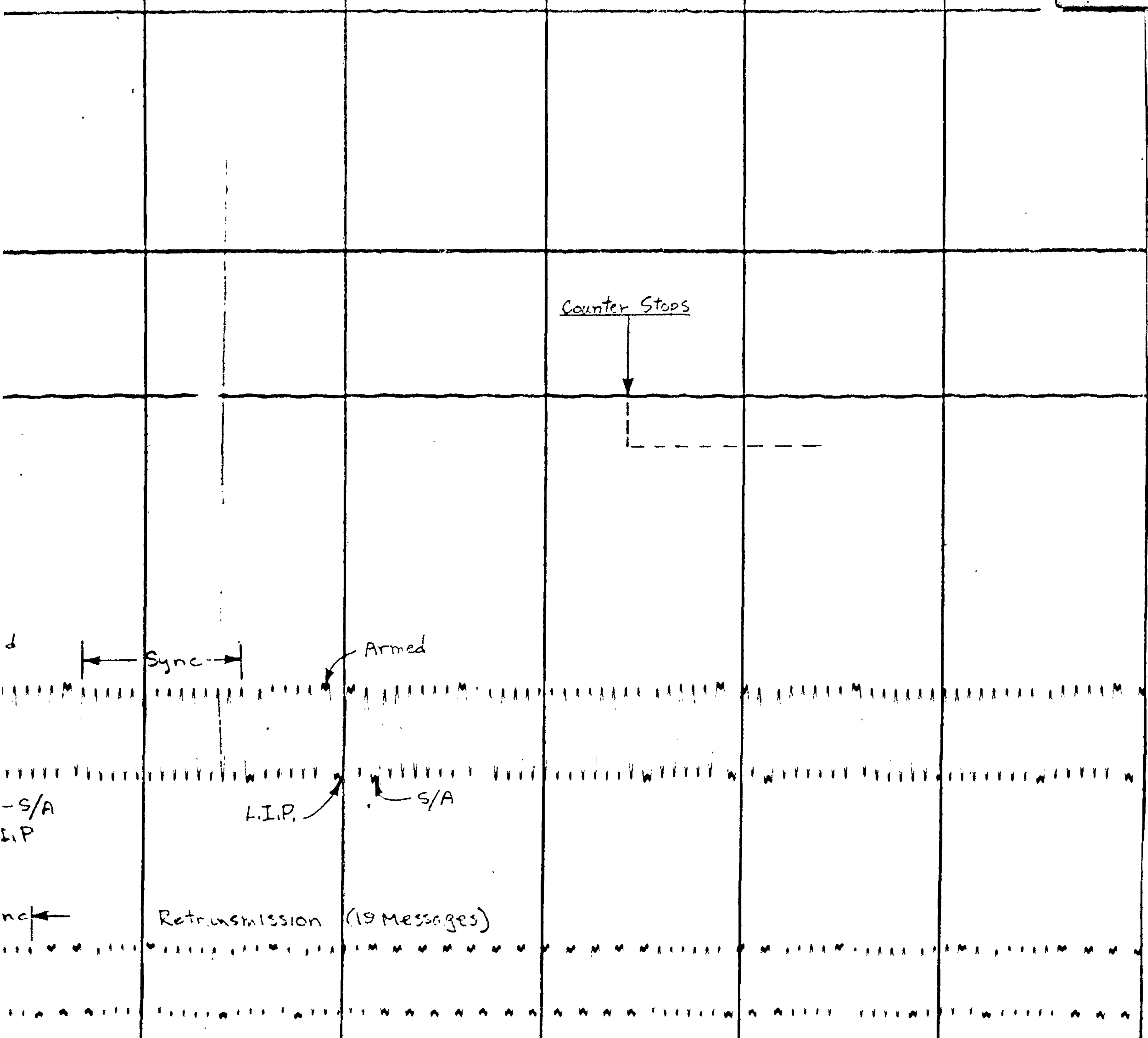
1

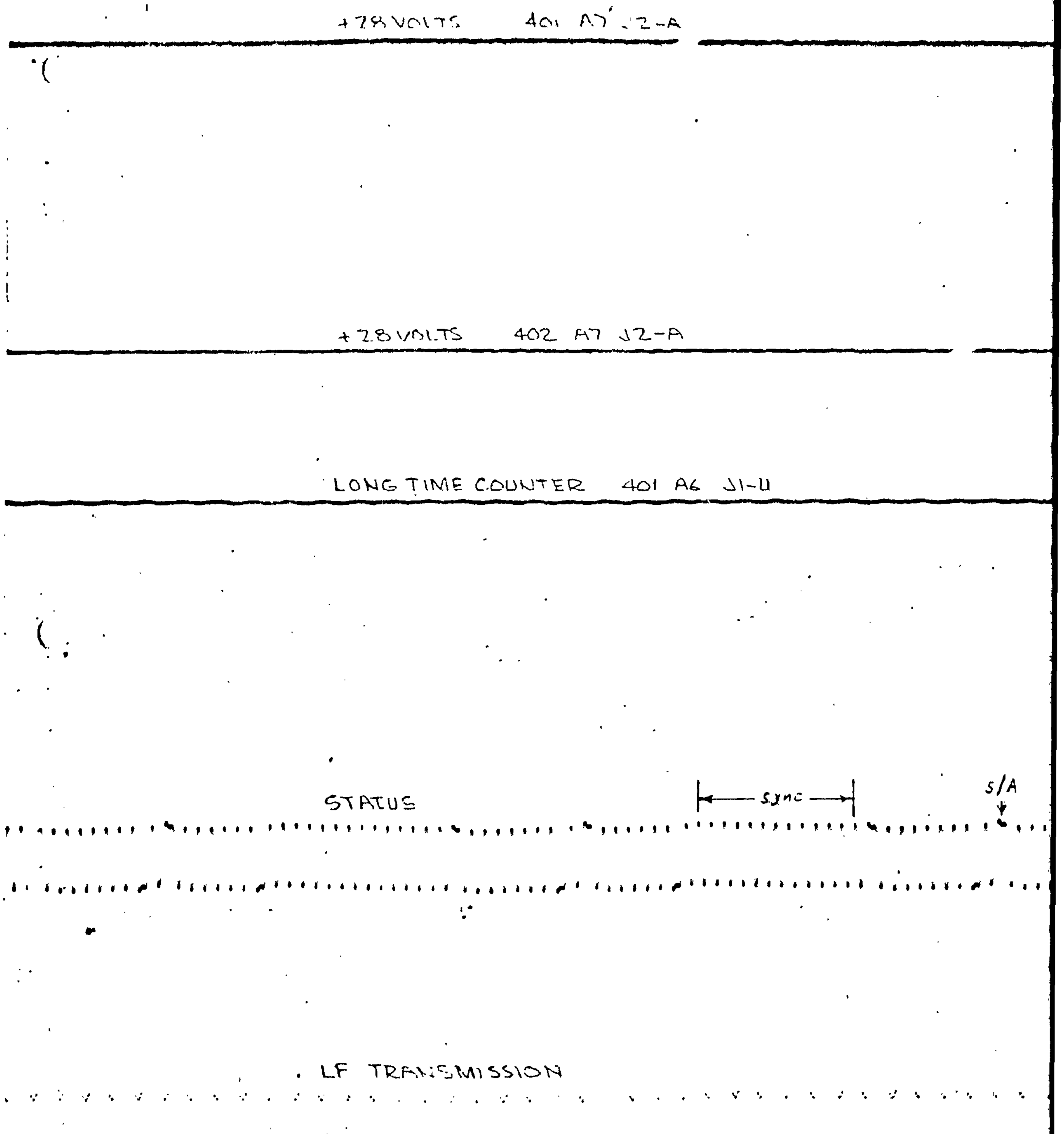

2
Sync
L/C
L.I.P.
S/A
Sync
Armed
Armed
L/C
S/A
L.I.P
sync

Oscillograph 3.2.3.2-2

One vote launch inhibited - Status change & retransmission. Input Voltage 22.02 volts.

3





+28 VOLTS 401 A7 J2-A
+28 VOLTS 402 A7 J2-A
LONG TIME COUNTER 401 A6 J1-U
STATUS
sync
S/A
LF TRANSMISSION

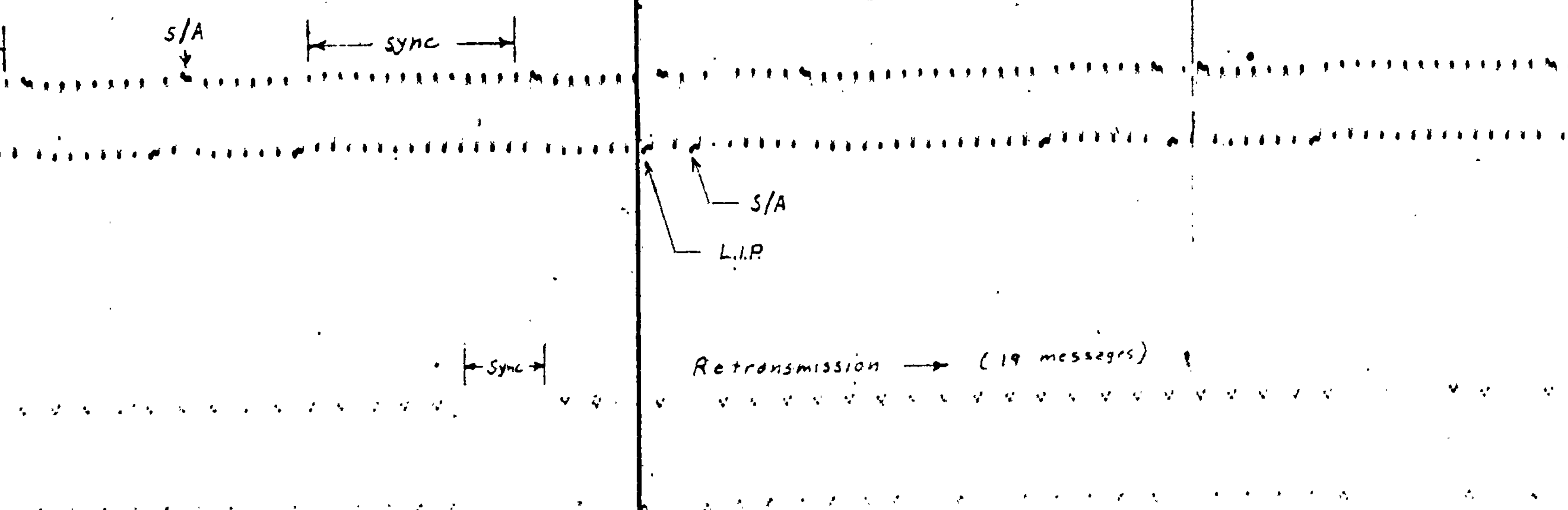
1

OSCILLOGRAPH 3.2.3.2

SCNT - STATUS CHANGE & RETRANS
INPUT VOLTAGE +22.02 VOLTS

NOTE:
LF WAS NOT ARMED WHE
THEREFORE, THE LONG TIME
START & NO STANDBY INDICAT

2



REV. SYM B

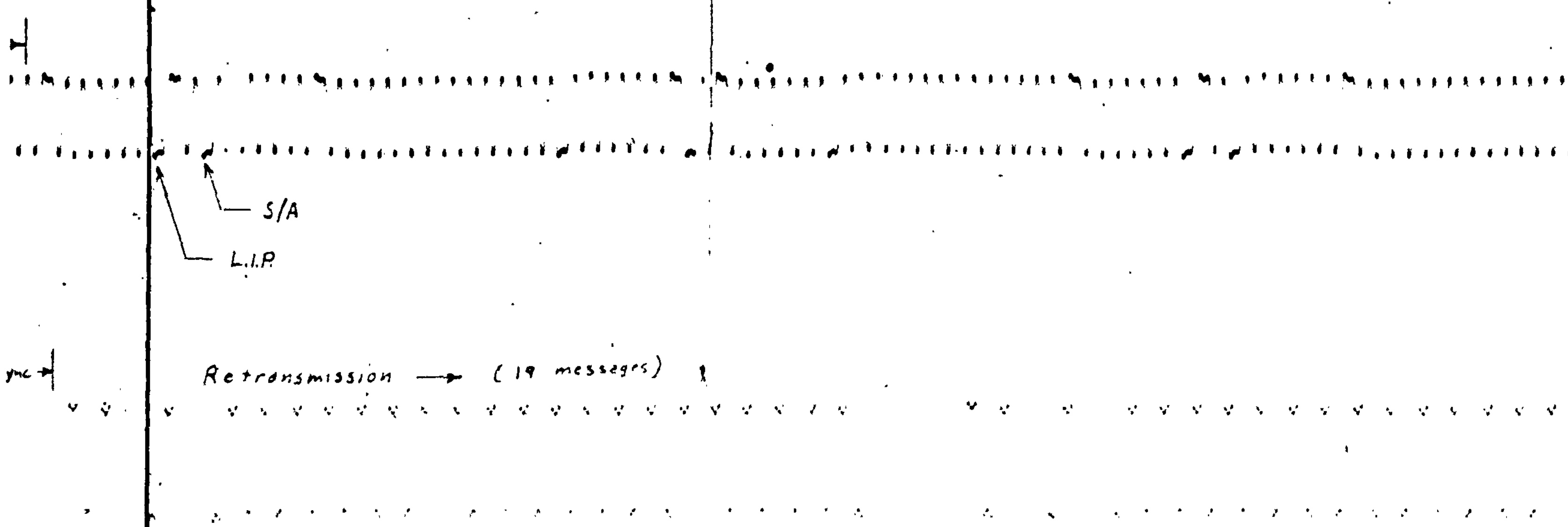
OSCILLOGRAPH 3.2.3.2-3

SCNT - STATUS CHANGE & RETRANSMISSION.
INPUT VOLTAGE +22.[illegible]2 VOLTS

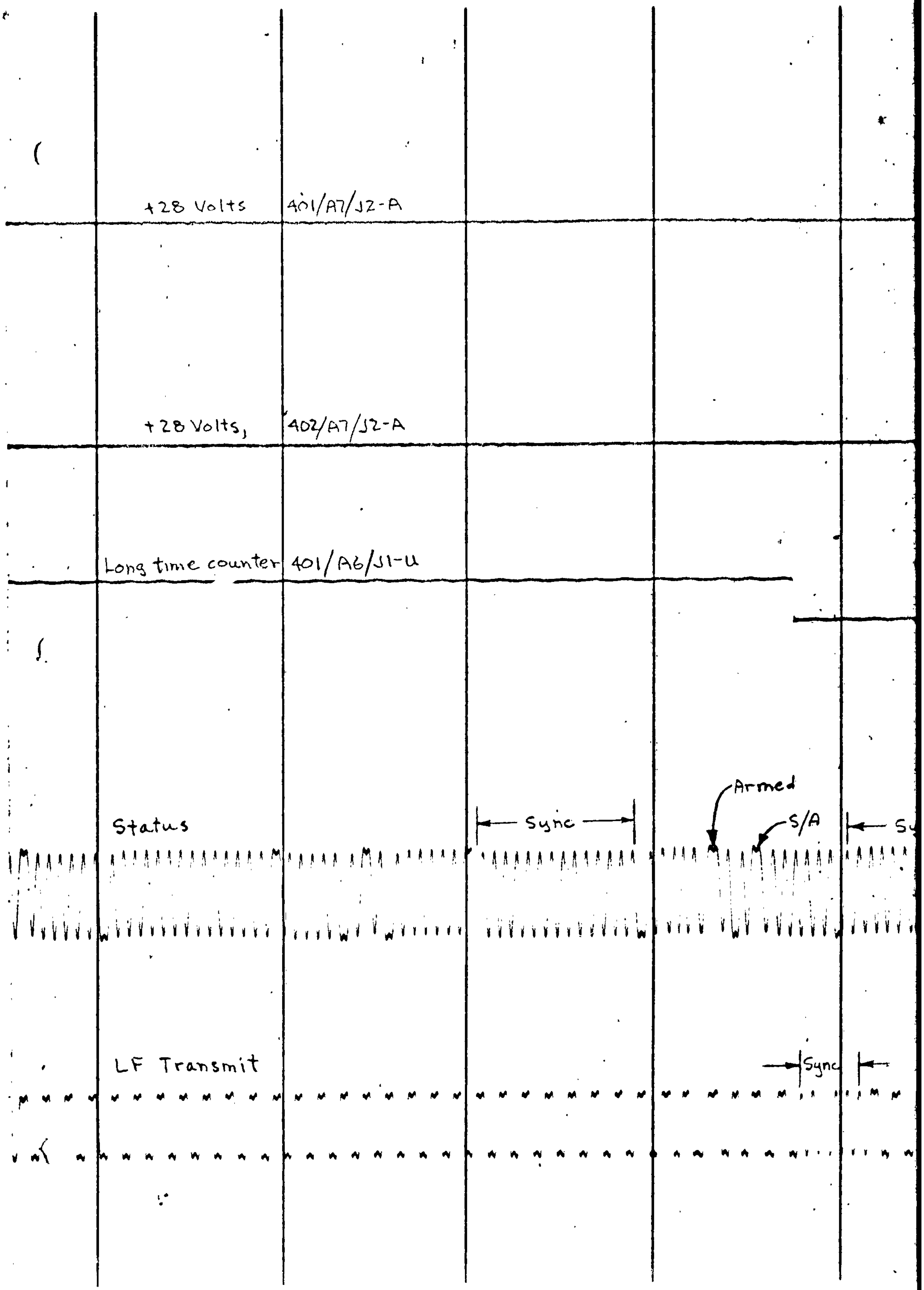
NOTE:

LF WAS NOT ARMED WHEN SCNT WAS SENT. THEREFORE, THE LONG TIME COUNTER DID NOT START & NO STANDBY INDICATION WAS OBSERVED.

3



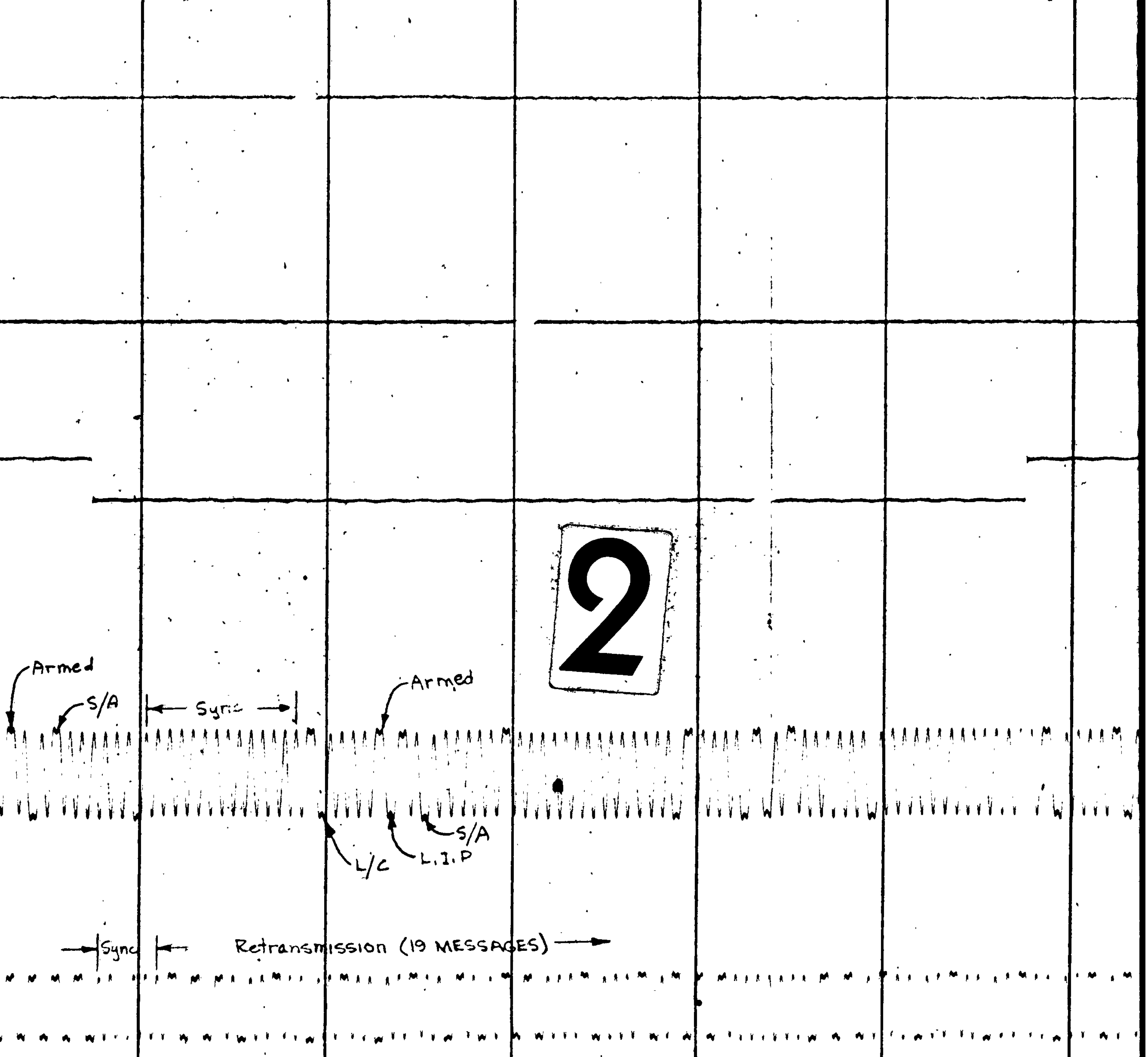
REV. SYM B


+28 Volts
401/A7/J2-A
+28 Volts,
402/A7/J2-A
Long time counter
401/A6/J1-U
Status
Sync
Armed
S/A
LF Transmit
Sync

1

Oscillograph 3.2.3.2-4

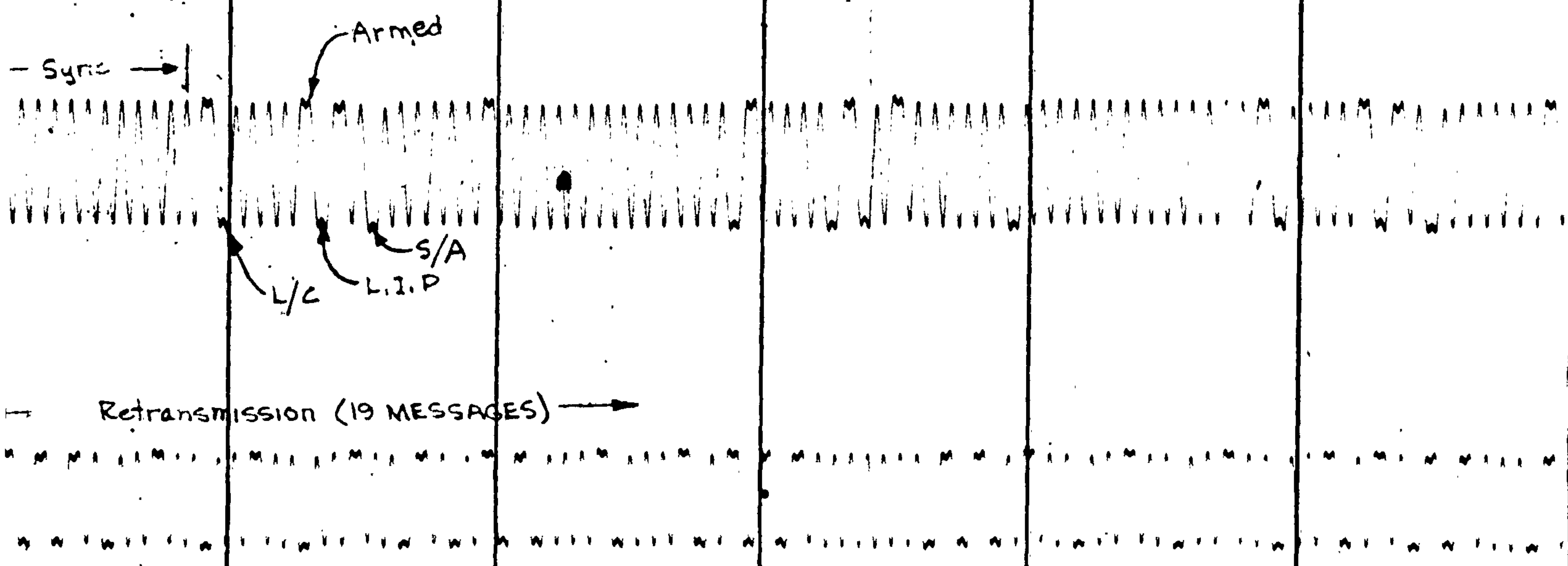
One vote launch - Status change & retransmission Input Voltage +27.02 V



Oscillograph 3.2.3.2-4

One vote launch - Status change
& retransmission Input Voltage +27.02 Volts

3



REV. SYM. B

TEST REPORT 3.2.3.3

1. TITLE

Effects of 400 cps Voltage Variation upon the LF System

2. OBJECTIVES

To investigate the effects of lower 400 cps voltage to the LF System.

3. CONCLUSIONS

3.1 The LF would proceed through a launch sequence at 70 volts 400 cps supply.

3.2 At 63 volts 400 cps the Safety Control Switch automatically arms itself.

3.3 The LF will not react to any commands at 60 volts 400 cps supply.

4. EQUIPMENT IN TEST

4.1 Digital Data Group (401), P/N 8323616-505, S/N 0000005.

4.2 Status - Command Message Processing Group (402), P/N 8323617-504, S/N 0000004.

4.3 Programmer Group (403), P/N 25-22036-89, S/N 0000034.

4.4 G&C Coupler (412), P/N 60950-305, S/N A002B.

4.5 LF Start-Up and Missile Simulation Equipment ACO 100, ACO 102, ACO 112 and ACO 114.

5. TEST DESCRIPTION

5.1 The equipment was connected per Figure 3.0.0.0-1, except for the LF MG Set. The Control MG Set was used in place of the LF MG Set.

5.2 It was observed that the control of the Control MG Set voltage was too limited to perform this test. Therefore, a variac was inserted in the output lines of the control MG Set. The insertion of the variac was accomplished in the AC Switch Box.

5.3 The voltage and frequency output were observed at the test jacks of the AC Switch Box. Voltage was measured with a model 803 Fluke Meter. Frequency was checked with a Beckman EPUT Counter. Frequency varied only ± 2 cycles from 400 cps throughout the entire test.

5.4 The data recorded on the NRA recording system is as indicated by Paragraph 6.9 of the Summary of Test Results.

5.5 At each 400 cps setting, the following supply voltages were checked with the Fluke Meter. Programmer Group Drawer A6, Connector J1, Pin P used as common.

Pin	Nominal Voltage (DC)
J1 - 9	+28
J1 - 12	+28
J1 - 2	-10
J1 - 3	-10
J1 - 5	+10
J1 - 4	+10
J1 - 14	+17
J1 - 16	+15
J1 - 15	+11.5

5.6 At each 400 cps voltage setting, the current in phase A to the coupler and to the programmer group was recorded.

5.7 At each input setting, commands were initiated from the LCF, and proper response was observed by watching the lamps on the Launch Control Console and the Missile Simulation Equipment.

5.8 In all cases when a two vote launch was desired, Pin k of the J1 connector of Drawer A5 in 401 Rack was momentarily grounded for the first launch vote. The second launch vote was supplied from the LCF.

6. SUMMARY OF TEST RESULTS

6.1 In all cases, the LF was first brought to strategic alert and then the voltage was lowered.

6.2 The input 400 cps voltage was lowered in the following increments:

120.0 V
111.6 V
90.0 V
80.0 V
70.0 V
60.0 V

6.3 At 70 volts input the Programmer Group would not complete a 60 second test sequence. A No-Go shutdown was observed 33 seconds after the beginning of the sequence. The Coupler did not send out the "Coupler Test Loop" command to the simulated G & C Section (G & C Coupler Test Set). No indications were observed on the VRSA Fault indicator.

6. SUMMARY OF TEST RESULTS 6.3 (Con't)

At 60 volts the SCN equipment would not process any commands. Therefore the launch system is disabled and is inoperative at this low voltage even though the system did not drop out of Strategic Alert.

6.4 It was observed that the Safety Control Switch would not respond as rapidly at lower voltages. At 70 volts input the Safety Control Switch had a time lag of approximately 5 seconds from the time the Armed Switch is activated.

6.5 At 63 volts input, the Safety Control Switch automatically armed itself.

6.6 Squib simulators were connected to the programmer group outputs and were fired during the Launch sequences.

6.7 The following sequence errors were injected from the SE 106.

1. Downstage No Go
2. Sequence Advance
3. Confirm Codes
4. Parity Errors

The normal response for each of these errors is an automatic restart. An automatic restart occured in all cases except at the 60 volt input. However, the system still couldn't complete the test sequence at 70 volts and therefore never returned to Strategic Alert.

6. SUMMARY OF TEST RESULTS (Con't)

6.8 A shut down command was initiated at the 60 volt input by depressing the site shutdown button on the front of the programmer group. There was no response to this command. The LF cannot be properly shutdown at this low voltage.

6.9 Oscillographic records for launch were developed at each input setting. Instrumentated signals were:

1. NCU and Electronics Power J4-25
2. Actuate Missile Batteries J4-65
3. Ignite 1st Stage Engine (#1) J4-68
4. Ignite 1st Stage Engine (#2) J4-69
5. Release G & C Umbilical (#1) J4-58
6. Release G & C Umbilical (#2) J4-59
7. Critical Leads Disconnect J4-1
8. Remove Closure (#1) J4-40
9. Remove Closure (#2) J4-41
10. Retract G & C Umbilical (#1) J4-43
11. Retract G & C Umbilical (#2) J4-44
12. Flight Program Entered J2-6
13. G & C Launch Command J2-14
14. Programmer Group Timing J2-4

The oscillograph recordings showed a normal launch at 111.6 volts, 100.0 volts, 90.0 volts. However, at 400 cps 80 volt input two spikes about 10 volts appeared at Ignite 1st Stage Engine at the beginning of the Launch Sequence. The Squib simulators were replaced, and another launch sequence was observed to

6. SUMMARY OF TEST RESULTS (Con't) 6.9

see if these spikes would ignite the 1st Stage Engine Squib simulator. The Squib Simulator for the 1st Stage Engine was not fired by these spikes. (see oscillograph 3.2.3.3-1)

6.10 NRA has been troubled by a random reset pulse which is passing through the LF SCN reset switch. In order to temporarily eliminate this problem, the output of the switch is grounded to J2-G of Drawer A7. This does not affect system operation; only the grounded output must be removed before the system can be reset.

6.11 The VRSA Unit was not available for the first portion of this test. A lashed up VRSA indicator was used to indicate faults. This VRSA Indicator did not simulate the operational VRSA. A VRSA Unit was obtained, and testing was continued.

6.12 Some trouble has been encountered in NRA recently with the SCN Test received lamp on the Launch Control Console. The lamp does not always illuminate when it should even at normal voltages. RCA Engineering has indicated that this problem is a result of an improper gain setting in the LCF. This problem does not affect the validity of this test.

7. GENERAL INFORMATION

7.1 Test Engineers:

Norman Noe

Richard Mathias

7. GENERAL INFORMATION (Con't)

7.2 Test Completed

3/21/63

7.3 The open ER's on Racks 401, 402, 403, and 412 are as follows:

U178426	U150095
U178449	U639183
U178450	U039176
U150046	E443966

SUMMARY OF TEST RESULTS

INPUT VOLTAGE	TEST	CALIBRATE	SCNT	LAUNCH	DC VOLTAGE READINGS, P/G	
111.6	Normal	Normal	Normal	Normal	J1 - 9	+28.031
					J1 - 12	+28.035
					J1 - 2	-10.031
					J1 - 3	-10.045
					J1 - 5	+ 9.996
					J1 - 4	+10.004
					J1 - 14	+15.734
					J1 - 16	+15.690
					J1 - 15	+11.489
100	Normal	Not Performed	Normal	Normal	J1 - 9	+28.050
					J1 - 12	+28.054
					J1 - 2	-10.060
					J1 - 3	-10.073
					J1 - 5	+10.003
					J1 - 4	+10.015
					J1 - 14	+14.084
					J1 - 16	+14.045
					J1 - 15	+11.503
90	Normal	Not Performed	Normal	Normal	J1 - 9	+25.495
					J1 - 12	+25.495
					J1 - 2	-10.055
					J1 - 3	-10.068
					J1 - 5	+ 9.994
					J1 - 4	+10.002
					J1 - 14	+12.363
					J1 - 16	+17.350*
					J1 - 15	+11.420

TABLE 3.2.3.3-1

* Oscilating 10 to 20 mv

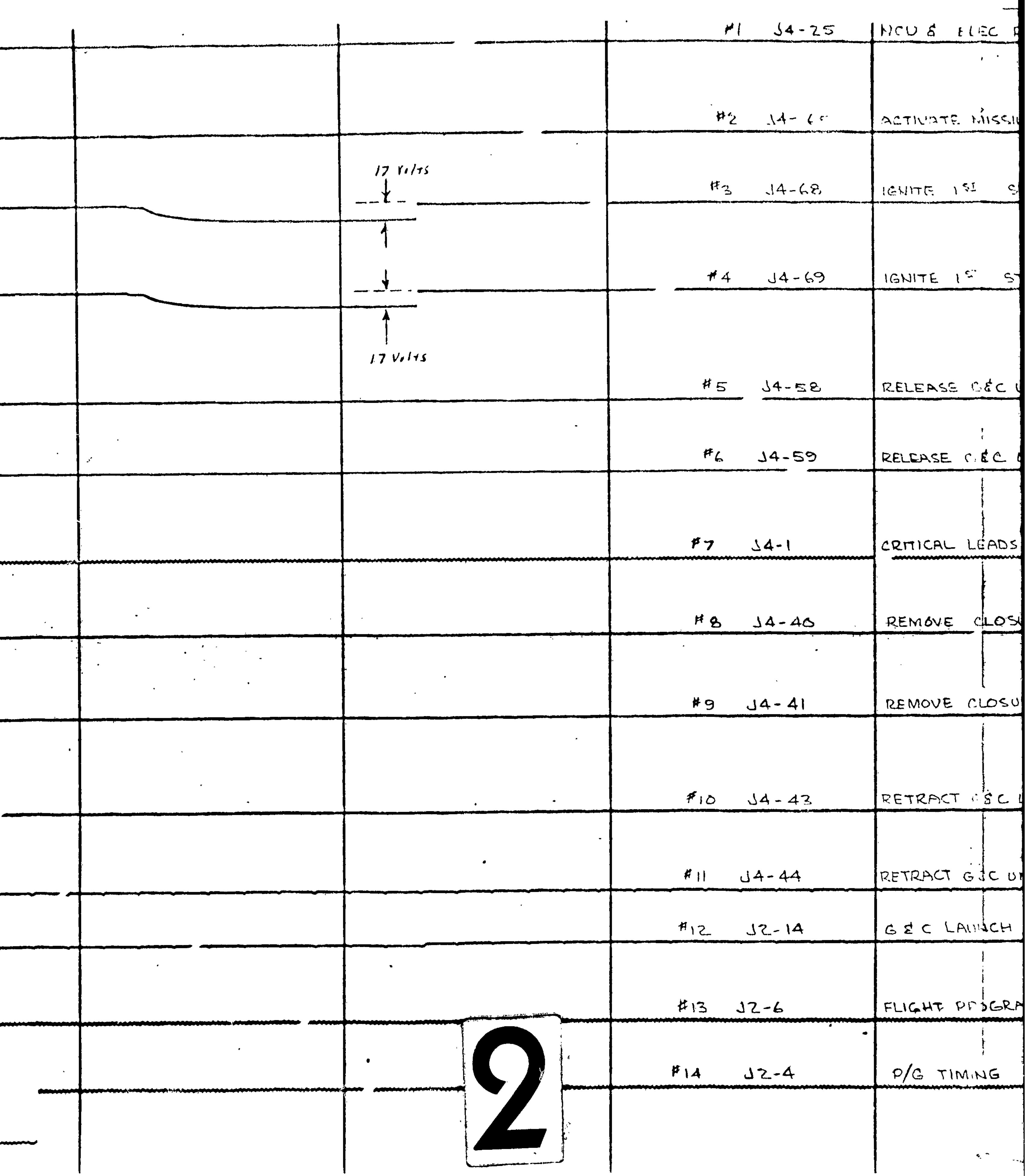
INPUT VOLTAGE	TEST	CALIBRATE	SCNT	LAUNCH	DC VOLTAGE (P/G)
80	Normal	Normal	Normal	Normal	J1 - 9 +22.520 J1 - 12 +22.520 J1 - 2 - 9.382 J1 - 3 - 9.394 J1 - 5 + 9.87 * J1 - 4 + 9.87 * J1 - 14 +10.89 J1 - 16 +10.830 J1 - 15 +10.020
70	Would Not Complete Test (Shut Down) **	Normal	Normal	Normal	J1 - 12 +19.5 * J1 - 2 - 7.950 * J1 - 3 - 7.960 * J1 - 5 + 8.406 * J1 - 4 + 8.416 * J1 - 14 + 9.420 * J1 - 16 + 9.340 * J1 - 15 + 8.581 *
60	System would not react to any commands. Indications at Launch Control Console show Strategic Alert and Armed, even though the armed switch at the CCC is in the safe position				J1 - 9 +16.426 J1 - 12 +16.429 J1 - 2 - 6.515 J1 - 3 - 6.523 J1 - 5 + 6.940 J1 - 4 + 6.947 J1 - 14 + 7.950 J1 - 16 + 7.840 J1 - 15 + 7.165

TABLE 3.2.3.3-1 (cont'd)

** Fails 33 sec. after entering test sequence

* Unstable - Oscillates 20 mv

1



17 Volts
17 Volts
#1 J4-25 NCU & ELEC
#2 J4-6 ACTIVATE MISSI
#3 J4-68 IGNITE 1ST S
#4 J4-69 IGNITE 1ST ST
#5 J4-58 RELEASE G&C
#6 J4-59 RELEASE G&C
#7 J4-1 CRITICAL LEADS
#8 J4-40 REMOVE CLOSU
#9 J4-41 REMOVE CLOSU
#10 J4-43 RETRACT G&C
#11 J4-44 RETRACT G&C U
#12 J2-14 G & C LAUNCH
#13 J2-6 FLIGHT PROGRA
#14 J2-4 P/G TIMING
2

				OSCILLOGRAPH 3.2.3.3-1
MCU & ELEC PWR				
ACTIVATE MISSILE BAIT				3
IGNITE 1ST STAGE #1				
IGNITE 1ST STAGE #2				
RELEASE G&C UMBILICAL				
RELEASE G&C UMBILICAL				
CRITICAL LEADS DISCONNECT				
REMOVE CLOSURE #1				
REMOVE CLOSURE #2				
RETRACT G&C UMBILICAL #1				
RETRACT G&C UMBILICAL #2				
G&C LAUNCH COMMAND				
FLIGHT PROGRAM ENTERED				
P/G TIMING				

REV. SYM B